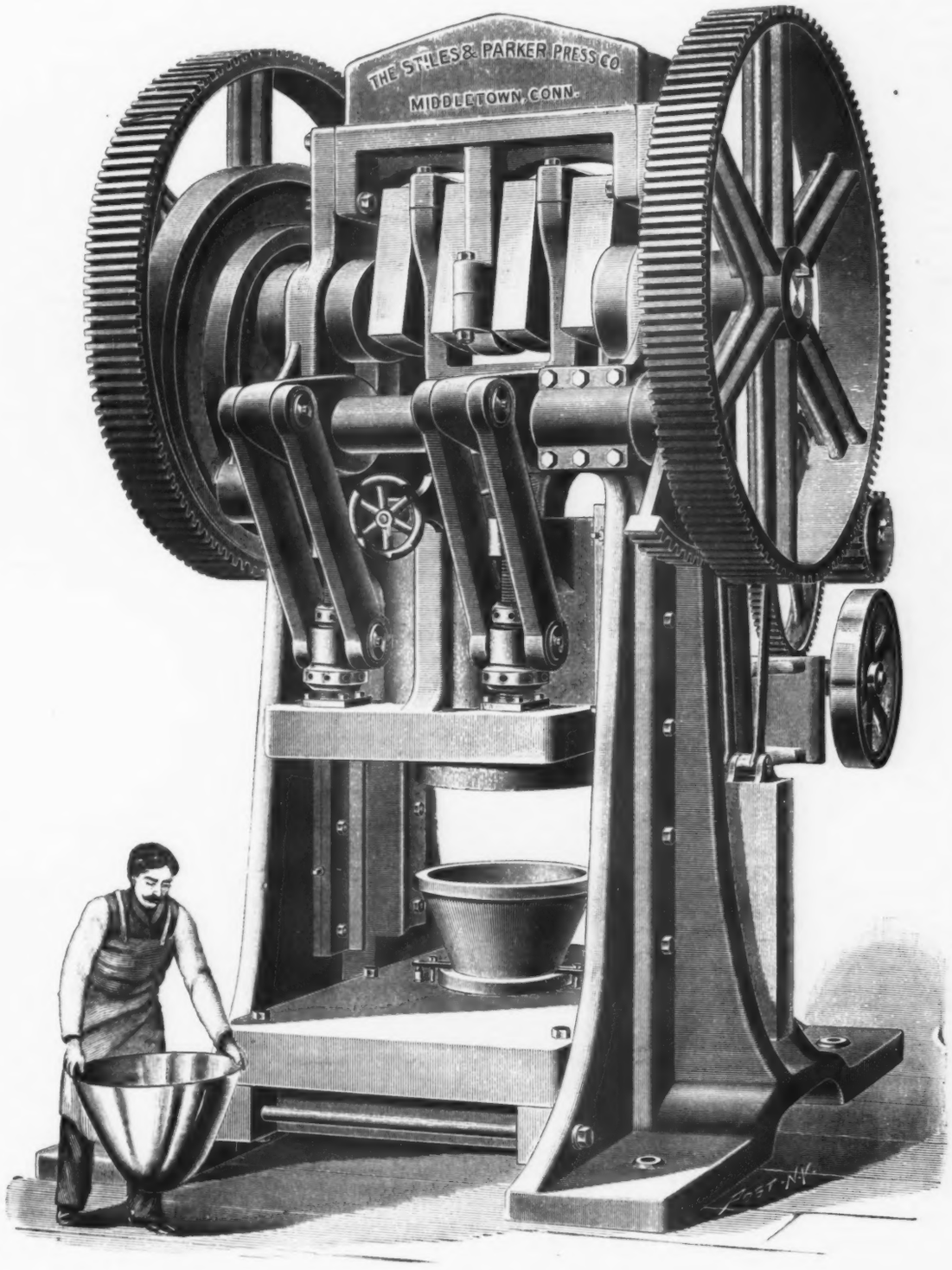
THE IRON AGE

THURSDAY, OCTOBER 16, 1890.

Toggle Joint Drawing Press.

The accompanying engraving represents the largest drawing press made by the Stiles & Parker Press Company, of Middletown, Conn., and 205 Center street, New York. The first machine of this size was shipped some time since and the second one is now well under way.

This press weighs 130,000 pounds and is designed to meet the requirements of manufacturers of very deep and heavy drawn goods, including the largest kind of tinware, copper goods, sheet steel, iron goods, &c. Among the articles which can be drawn on them are steel sinks, reflectors for locomotive headlights, ship ventilator halves, stove tops, large trays and many other articles of large dimensions. It is stated that they are much heavier and stronger in all their parts than the presses hitherto put on the market for these purposes, and can be operated with greater ease and less expenditure of power. Length of blank holder stroke, 22 inches; length of punch stroke, 36 inches; adjustments of blank holder and punch, 14 inches; distance between uprights, 73 inches; bottom of blank holder slide, 60 x 60 inches; distance from bed to bottom of outer slide, when slide and adjustment are up, 53 inches; largest blank, 60 inches; largest punch for deep work, 36 inches; largest punch for shallow work (for depths not exceeding one-sixth of punch stroke), 48 inches; size of fly wheels, 38 x 6 inches; speed of fly wheels, 250 revolutions; proportion of gearing 1 to 63; number of



THE STILES TOGGLE JOINT DRAWING PRESS.

strokes per minute, 4; diameter of large gears, 109 inches; floor space, about 114 x 115 inches; extreme hight, 18 feet.

This press embodies the results of experiments extending over many years. The object of these experiments was to discover a mechanism imparting the same kind of movement to the blank holder slide which is used in the "cam" drawing presses, and obviating, on the other hand, the many serious defects which are unavoidable where the blank holding is effected by the direct action of cams. The pressure required to hold even a medium sized blank amounts to a great many tons. In "cam presses," as hitherto made, this heavy pressure falls on the cams and their faces, while they are rapidly revolving in contact with the rollers beneath them, and on the slender pins on which these rollers are supported. The cam and roller surfaces, thus moving under exceedingly heavy pressure, soon lose their accuracy and smoothness, when, instead of holding the blank with absolute steadiness, which is the most essential requirement in drawing sheet metal, they put a constantly varying pressure on the blank. The consequence is that frequently metal of greater thickness than is desirable has to be used in order to make it stand under the uneven pressure of the blank holder, or where it is impracticable to use thicker metal, a greater number of operations have to be resorted to for finishing the article.

Another difficulty, for which press makers have long been seeking a remedy, is that when the cams have brought the blank holder down and are putting upon it the required pressure the plunger or drawing action commences, and since this is affected by the same shaft the increased strain on it causes it to spring slightly, and thereby partially relieve or decrease the pressure on the blank holder just at the time when it is important that it should be fully maintained. This is the origin of the "top wrinkle" so often seen in deep drawn articles, and which it is very desirable to avoid.

In designing this toggle joint drawing press the object was to obviate these difficulties and produce a press in which the least possible wear and yielding under pressure shall take place, and to so arrange that what wear does take place shall have no effect on the action of the machine. The upper members of the toggle joints are swiveled on heavy studs or shafts, fastened in the main frame of the press, while the lower ones are seated in the blank holder slide. The construction of the presses is such that during the first half of the plunger's descent, the toggle links move toward their straightened position, which they maintain during the rest of the down stroke of the plunger. It will be understood that when the toggles are straightened, that is to say, their three working centers on the same vertical line, there is absolutely no further movement of the blank holder, and that this positive standstill lasts not for a moment only, but during that whole portion of the stroke, which is technically known as the "dwell." It is stated that this constitutes the principal point of superiority of this machine over other toggle drawing presses, in which the toggles are really never at a perfect standstill, and which, therefore, instead of obviating the irregularities of cam presses, make it even less possible to keep a uniform pressure on the blank. The strain arising from the pressure put upon the blank is transferred through the straightened toggle links to the frame of the press, relieving entirely the main shaft from all friction and wear due to the blank holding. A uniform pressure is put on the blank during the whole operation of drawing.

A tract of 16 acres in the southern part of Chicago has been purchased by the American Malleable Iron Company, who pay $3000 an acre, or $48,000 for the tract. This company, which has a capital of $500,000, has among its members such men as Franklin H. Head, E. B. Bailey, H. S. Burkhard, John E. Wittemore, John E. Pope, of Cleveland, and others. New works to cost upward of $100,000, giving employment to nearly 500 men, will be erected at once and malleable iron castings manufactured. The tract is adjacent to the Illinois Central Railroad at Burnside Station.

An erroneous item appeared in our issue of September 25 concerning the American Foundry Company, of Tacoma, Wash., whose operations were to some extent confused with those of Parker & Topping. The facts of the case are as follows: Parker & Topping, of Brainerd, Minn., have the contract for making the castings for the Eastern division of the Northern Pacific Railroad. The American Foundry Company, of Tacoma, Wash., have the contract for castings for the Western division of the same road, Helena, Mont., being the dividing line. Parker & Topping, of Albina, Ore., have a contract for furnishing the castings for the Pacific division of the Union Pacific system.

Extraordinary Output of Charcoal Pig Iron.

M. R. Hunt, manager of the Hinkle Furnace, at Ashland, Wisconsin, owned by the Ashland Iron and Steel Company, reports that in the seven days ended October 4 his furnace turned out 1009 gross tons of pig iron. The best day's run was 150 tons and the worst 141 tons. The stack of this furnace is 60 feet high, and the diameter of the bosh is 12 feet. The work was done with all ores, no scrap or mill cinder being used. The ores came from the Gogebic range. This surpasses the record of any other charcoal or coke furnace of equal size, so far as we know. The accompanying tabulated statement gives full particulars of the whole week's run.

Date. 1890.	Charges in 24 hours.	Bushels of coal to each charge.	Pounds limestone.	Burden.	Particulars of ores each day. Globe.	E. Norrie.	Cary.	Tyler's Forks.	Rock pile.	Total.	Iron each day. No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Total.
September 28...	258	47	100	2300	178,020	118,680	116,100	116,100	64,500	593,400	16	105	26	....	....	....	147
September 29...	260	47	100	2300	179,400	119,600	117,000	117,000	65,000	598,000	73	4	33	16	21	....	147
September 30...	260	47	100	2300	179,400	119,600	117,000	117,000	65,000	598,000	....	14	100	20	6	....	140
October 1.....	239	47	100	2300	191,200	191,200	47,800	47,800	71,700	549,700	....	64	46	32	....	....	142
October 2.....	255	47	100	2300	204,000	204,000	51,000	51,000	76,500	586,500	79	63	....	....	....	....	142
October 3.....	257	47	100	2300	205,600	205,600	51,400	51,400	77,100	591,100	44	34	....	....	37	35	150
October 4.....	235	47	100	2300	188,000	188,000	47,000	47,000	70,500	540,500	17	38	86	....	....	....	141
Total.....	1764				1,325,620	1,146,680	547,300	547,300	490,300	4,057,200	229	322	291	68	64	35	1009
										Previous total.	2341	3162	1170	265	148	128	7214
	Average speed of engine 36 revolutions per minute, equals 9540 cubic feet of air per minute.									Grand total...	2570	3484	1461	333	212	163	8223

Recapitulation.

Furnace Run	1764 charges.
Coal consumed	82,908 bushels.
Bushels coal per ton (22 pounds to bushel	82 17-100
Pounds ore consumed	4,057,200
Pounds ore to ton iron	4021
Yield per cent. ore	56 40-100
Tons limestone used	88
Pounds limestone per ton	174

Furnace Register of the Ashland Iron and Steel Company. Blast No. 3, Fifty-sixth Week.

The project of driving a 5 mile tunnel straight through the backbone of the continent, entering the snow capped range of the Rocky Mountains proper in Clear Creek County, Col., 60 miles due west from Denver and coming out at or near the head of Snake River, in Summit County, on the west side of the range is making good progress. One result will be the shortening of the railway distance between Denver and Salt Lake City 200 miles. The thick granite crust of Mount Kelso has been penetrated 3000 feet and the bore on the west side, at Ruby Mountain, measures 1400 feet. It is said that the veins of precious metal already cut into are worth all it cost to reach them.

Another Elegant Sound Steamer.

The new steamer Plymouth, for the Fall River line, has made her trial trip with results fully up to expectations and is ready for service. She will be a worthy consort for the Puritan and Pilgrim, which she much resembles in general outline and in other important particulars, although she is assumed to be an improvement on any of her predecessors. Her hull was constructed by the Delaware River Iron Shipbuilding Works, at Chester, Pa., and the engine builders are the W. & A. Fletcher Company, of New York, otherwise known as the North River Iron Works. Her length over all is 366 feet, and over the water line 351 8 inches; breadth over guards, 86 feet; breadth of hull, 50 feet; draft of water, loaded, 12 feet; distance from keel to top of down deck, 55½ feet. The distinguishing feature is the style of engine—four cylinder, triple expansion, double inclined, of 5000 horse-power, the first introduced on an American boat.

The high pressure cylinder is 47 inches in diameter and the intermediate 75 inches. These are placed forward of the shaft, the two low pressure cylinders (each 81½ inches in diameter) being aft of the shaft. The maximum boiler pressure is 160 pounds. One low pressure is connected with the same crank pin as the intermediate and the other with the same crank pin as the high pressure. All of the pistons have a stroke of 8½ feet. Each low pressure cylinder has its own air pump and surface condenser, with independent circulating pump. The wheels are of the feathering type, like the Puritan's. They are 30 feet in diameter, outside the buckets. There are 12 steel buckets on each wheel, each 13½ feet long and 4 feet wide. Eight steel boilers, each 13 feet 1 inch long and 114 feet in diameter, supply the engine with power. The boilers are athwartships, back to back, thus making two firerooms. The single funnel through which the smoke from the furnaces goes skyward is 10½ feet in diameter, and the top is 86 feet above the water. An arrangement of the donkey engine and wrecking apparatus on the main deck, where there is no liability to be submerged, as was the case on the City of Paris, is a commendable feature. The sea trial on Thursday developed a speed of 20 miles an hour down the bay, and was enjoyed by a large number of engineers, builders and steamboat officials. The revolutions of the Plymouth's feathered wheels during the trip fluctuated between 23 and 26. They will make 28 revolutions under a pressure of 160 pounds of steam. Only 125 pounds were developed on the special trip. The engines worked with marvelous smoothness, and were stopped instantly and reversed on signal.

The probable cost of an electrical plant to operate the Ninth Avenue road, New York, has been figured out by the Traction Company, as follows: For 24 trains, 3157 horse-power, including an extra 10 per cent. of power for emergencies. This power is to be obtained from four 800 horse-power engines, only two of which are to be used excepting during the hours of heavy travel. These engines will require 41 tons of coal of a grade that can be purchased at from $1.80 to $2.25, and at the highest price would cost $92.25 The steam motors require 40 tons of high grade coal a day, which costs about $200.

The Chicago *Tribune* says good progress is making in freeing the city from smoke. The Olson burner is a steam jet device, and gives complete satisfaction. The Hutchinson burner has been applied to many large boilers in Chicago with pronounced success, and stands the test of being attached to locomotives. Several railroads running into Chicago are fast equipping their engines with this device. The Stevens burner is finding favor among tugmen; the Weber and the Cliff devices are used by many business men on stationary boilers. All these are steam jet devices. No complaint has been heard yet that they ruin boilers. Smoke Inspector Young says increased heat does not blister a boiler if it is accompanied by complete combustion, so that no soot accumulates.

Metal Reamers.

Reamers, as usual in an engineer's shop, says a correspondent of *Industries*, are implements that continually fail to meet the user's expectation. They either break, wear under size, or make untrue holes. Various modifications of them do not seem to bring much improvement; indeed,

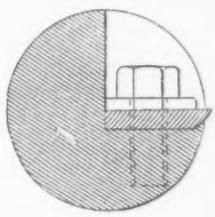


Fig. 1.

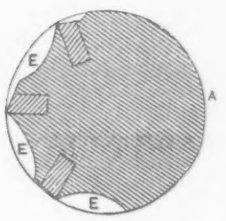


Fig. 2.

Metal Reamers.

the older ones are the best, as I hope to explain presently; but as to this I would like to invite the opinion of your engineering readers. Standard sizes for the cylindrical parts of machinery include holes as well as the parts that fit into them; indeed, the holes are the most important part, and a system of gauges is more a system of reaming than anything else. I propose to make some remarks upon reamers, of a particularly "heterodox" kind, among which the main one will be that common multibladed reamers are wrong in principle and can never work well when there is no contact except with the edges. There must be other support or "abutment" than cutting edges for any implement that produces true smooth work; nor is this a new discovery. Reamers with blades mounted, as in Fig. 1, were made by John G. Bodmer, and are described in one of his patents of more than 40 years ago. He had found out, doubtless by experience, that reamers without abutment would not make true smooth bores. Going still further back, even centuries ago, we find the bore of fire arms, almost the only kind of true holes required, were made by square reamers, or others with an abutment of wood that partially filled the bore. Still later than Bodmer, I may cite the experience of J. Morton Poole who was the inventor of a very ingenious system of grinding calender and other accurate rollers, some of which required an axis of steel or iron, fitting the whole length. To make such holes he employed reamers up to 30 inches long, made substantially like that by Bodmer in Fig. 1.

A common machine drill is a fair illustration of a multibladed reamer, in so far as the cutting support falls on cutting edges, and the result produced, although for obvious reasons less accurate than that of the reamer, the nature of the operation is the same. No one ever thinks of "drilling" a true smooth hole, unless it might be with a twist drill that fits closely in the bore, and thus gives an "abutment" for the cutting edges. If one goes into any machine shop where accurate smooth holes are required to be made, he will find in nearly all cases, perhaps all, some modification of a reaming apparatus, corresponding to Fig. 1—that is, with some kind of a permanent support behind or opposite the cutting edges, and the problem arises, Why not make all reamers to conform to this method? It will cost no more, perhaps less, to insert two or three blades, as in Fig. 2, leaving half or more of the stem or barrel at A for support of the cutting action. The throats at E E E might have greater depth than shown in the illustration, so as to hold more chips, but they will hold as much as should be cut away with a finishing reamer. Any maker of such implements will supply them in this form without extra cost, and an experiment would prove the soundness or otherwise of the premises that I have assumed here.

A Large Chicago Building Contract.

A building contract for something like $3,000,000 was signed last week. The building to be constructed is reported to be the largest in the world. The contract was let by Otto Young to George A. Fuller & Co. The building is the new "Fair" structure, a mercantile enterprise, to occupy the south half of the block bounded by State, Adams and Dearborn streets. The entire construction of the building is covered by this one contract. The firm that is to build it now has under way some of the most notable structures in the city, among them the Women's Temperance Union Building, at La Salle and Monroe streets, and the tall Monadnock, at the corner of Dearborn and Jackson streets. The new Fair building will be 16 stories high and will cost not far from $3,000,000. When completed it will represent a value of $6,000,000, for the ground on which it will stand is leased at an annual rental of $154,000, which capitalized on the usual basis of 5 per cent. makes the property represent $3,080,000. There will be room in the new building for two and a half such stores as the Bon Marché of Paris, which has long been world famed as the greatest of retail mercantile establishments. The work will go on so as to interfere with the business of the store but slightly. The Dearborn street frontage will be built up three stories high, roofed over and occupied. Then the Adams street frontage and last the State street frontage will be put up in that way. The remaining 13 stories will be added without interfering but little with the business going on in the lower stories. The building will be absolutely fire proof. It will require about three years to complete the structure.

The Elgin *Daily News* prints particulars of the probable location of another large industry in Elgin, Ill. T. J. Linton, of Providence, R. I., has been working quietly for some weeks securing options on land and guarantees of aid in the shape of land and buildings. Everything looks favorable for the consummation of an important enterprise in the shape of a brass rolling mill, novelty works, and eventually another watch case factory. Chicagoans are interested in the project.

Rolling Seamless Pipe From Hollow Ingots.

[*With Supplementary Sheet of Engravings.*]

The Kellogg machine for converting hollow ingots into seamless pipe or similar articles consists of an organized machine composed of a series of rolls, alternately horizontal and vertical, supported in proper and suitable housings, which are secured to the bed plate of the machine, which is anchored to masonry. A perfectly positive motion is secured throughout by means of properly proportioned gear wheels.

The accompanying cuts give a general idea of the machine. Fig. 1 is a plan view, Fig. 2 is a side view of the pinion housing and Fig. 3 is a section, showing the two machines. They are built in pairs, with the pinion housing between them, one for blooming and the other for rolling pipe.

Power is transmitted from the engine shaft by the gearing shown, the engine being of the vertical pattern, and having a fly wheel weighing 25 tons, with cylinder 30 x 50 inches. The speed of each pair of rolls is calculated so that it will exceed the pair ahead of it by the percentage of reduction made by that pair; for instance, the first pair makes a reduction of 25 per cent., and has a speed of 25 revolutions per minute. In other words, the speed is sufficient to just take up the additional elongation caused by the reduction of the sectional areas of the ingot or bloom by the preceding pair of rolls, and so on through nine successive pairs of rolls, the last one delivering the pipe with the desired thickness of wall. This thickness can be varied to suit circumstances and conditions by changing the sectional area of the several sections on the mandrel, making thin walled pipe or thick. The mandrel, Fig. 4, extends the entire length and through the center of the machine, and on it are placed sections which preserve the interior shape. These sections are supported on a spindle, which is part of the mandrel, and separated by iron sleeves, so as to keep them in proper positions between each pair of rolls. The general arrangement of the mandrel, pipe and rolls is shown in Fig. 5

The sectional area of these sections may be round or elliptical, or may be alternately round and elliptical. The mandrel is grasped by two grips, which consist of two levers pivoted together near their centers and shaped in their upper ends the same as the stem of the mandrels. The piston of a steam cylinder is connected with the jaws or levers, and is arranged so that when one is open the other is closed, and both cannot be opened at the same time. The mandrel is held in the center of the pass by an adjustable roller support, Fig. 2, between the first and second pairs of rolls; it is pivoted and counter weighted on the lever arm so as to return to the proper position after the ingot or bloom has passed that point.

The ingots are cast hollow; after heating, they are put through blooming, which reduces the thickness of the wall more than one-half; these blooms are reheated and passed through this machine, which by one pass delivers a perfect pipe.

The operation of the machine is as follows: The bloom being at a rolling heat, is slipped over the end of the mandrel and passed through the first grip, which is open, while the second one is closed; the first grip is then closed, and the second opened and the bloom pushed forward and into the bite of the first pair of rolls, where it is rolled into an elliptical form; it passes into the next pair, which reduces it and rolls it to a circular form, and so on through the mill, being made oval at one pair of rolls and round at the next, the last pass giving it a circular and finished form. Thus a finished pipe is turned out in one heat, in the same time as the last pass is made in rolling bar iron.

The improvement of the machine is that different sizes of pipe can be made in it by simply changing the rolls, since, as the least diameter of the rolls is the same for all the different sizes of pipe calculated to be rolled by machine, then, when the speed of the rolls is properly proportioned for one size of pipe, it will be right for all within the scope of the machine.

The diameter of the barrel of the roll varies according to the size of the pipe rolled; it will be seen that the centers of the rolls are nearest together when rolling small pipe, and furthest apart when rolling large pipe. As the centers of the shafts in the trains are fixed, the movable center of the roll is connected with the motive shaft by means of a "wabbler," shown in Fig. 3, one for the horizontal roll and one for the vertical roll. The driven vertical roll is supported by an adjustable step, shown also in section.

The last two pairs of rolls make very little reduction in the thickness of the wall, this work being simply to finish and polish the pipe. The first pair of rolls is intended to center the ingot or bloom entering the machine, the reduction being made before the pipe reaches the last two pair of rolls.

The machine here shown is designed for rolling all sizes of pipe and boiler flues from 3 to 7 inches, and the drawings have been completed for one to roll from 8 to 16 inches, the larger sizes being made with equal rapidity. Drawings are now being made for a machine to roll seamless tubes from 36 to 48 inches in diameter, 20 feet long, with any thickness of wall from $\frac{1}{8}$ to $\frac{1}{4}$ inch; a boiler can be made then by simply riveting in the heads.

It is very evident that the product, in the shape of thin steel pipes of great strength and minimum weight, of a machine of this kind would find wide and quick acceptance, and would certainly displace for a vast number of purposes the pipes now common. It is stated that these pipes can be produced at much less cost than lap welded, and of course for less than cast iron pipe when the decreased weight and increased strength are considered.

The machine is the invention of Charles Kellogg, and is controlled by the Kellogg Seamless Tube and Mfg. Company, of Findlay, Ohio. It has been patented in the United States, England, France, Germany, Belgium, Spain, Austria and Russia.

Fig. 4.—The Mandrel.

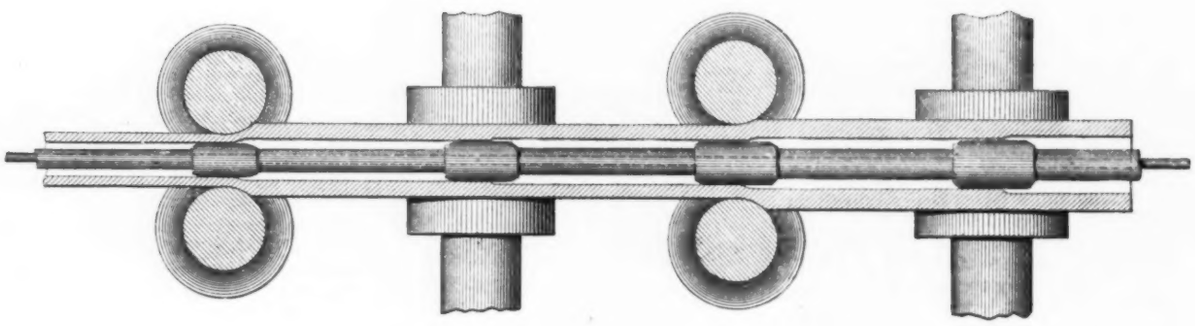


Fig. 5.—Showing Arrangement of Mandrel, Pipe and Rolls.

The appropriation of $1,000,000 by Congress for the purchase of the Creuzot nickel armor plate for naval vessels has an important bearing upon some of the new vessels not yet completed at the Brooklyn station, as, for instance, the armored cruiser Maine, Cruiser No. 7 and the barbette monitors Puritan and Terror. As not a single plate of armor for these vessels has yet been turned out, and the contract is with the Bethlehem Works, which is now putting in the Creuzot plant, it is probable that the armor will be of the nickel plate. Naval Constructor Mintonye has been for several weeks at work on the schedules and drawings showing the size, shape and weight of each particular piece of armor required. The total amount required of side armor, barbette armor, turret armor and conning tower for the Maine is 2,367,274 pounds; the total amount required for the barbette turreted monitor Puritan is 2,280,487 pounds, and for the Terror is 1,358,580 pounds. Although the total amount of side armor for the Maine is 1,102,550 pounds, that of the Puriton is 1,298,102 pounds.

Capt. F. L. Norton is about to start on a transatlantic voyage in a steamer 60 feet in length to illustrate the practicability of a new system of water ballast.

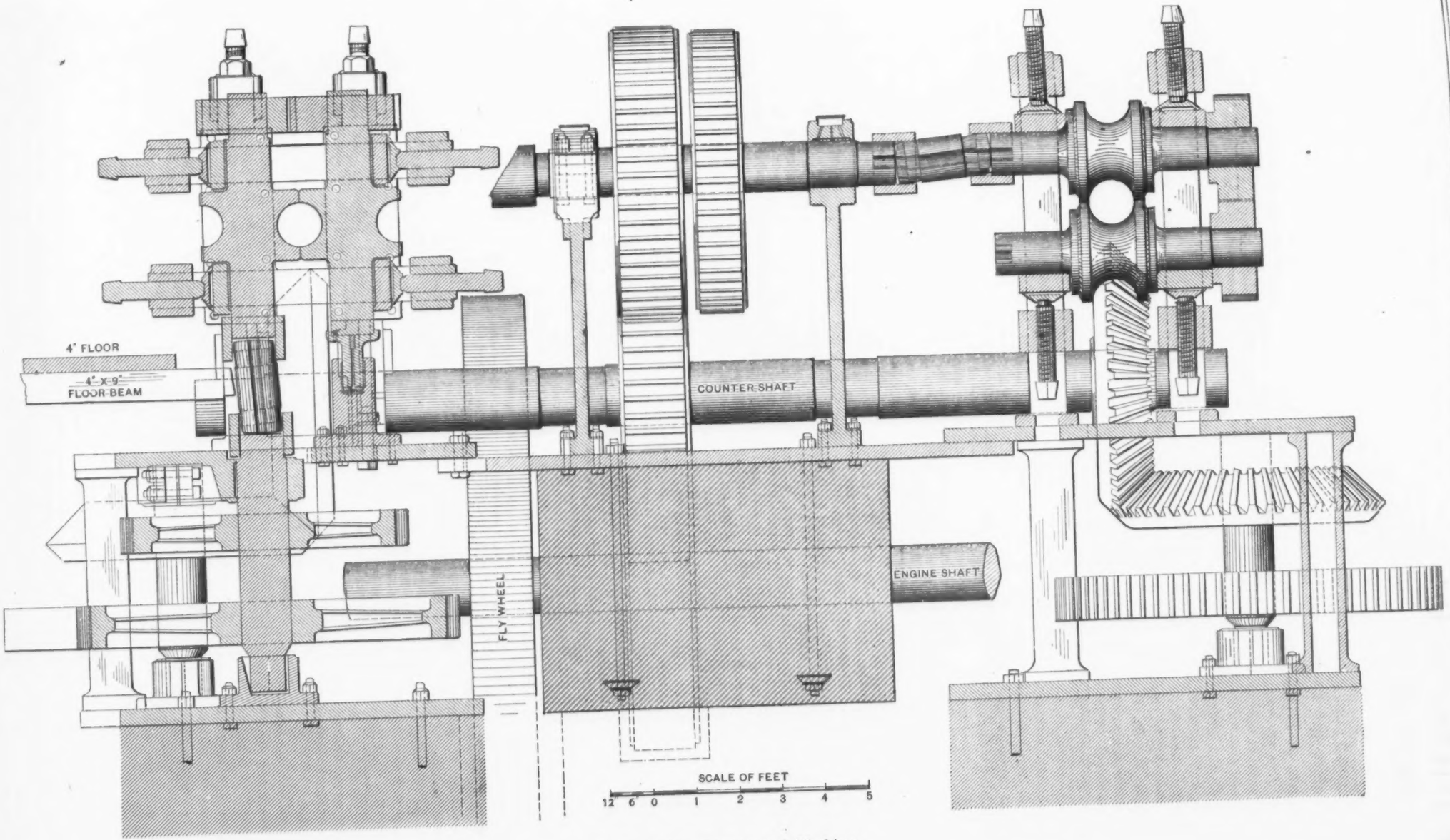


Fig. 3.—Section through Both Machines.

ROLLING SEAMLESS PIPE FROM HOLLOW INGOTS.

THE INTERNATIONAL MEETING.

British, German and American Metallurgists and Engineers in Session at Pittsburgh.

After the series of entertainments and excursions in and about Philadelphia, the entire party of iron and steel producers and engineers were conveyed to Altoona, arriving there on the 8th. Under the guidance of Theo. N. Ely, chairman of the local committee, and Dr. C. B. Dudley, the shops of the Pennsylvania Railroad Company were visited. The short time at the disposal of the visitors permitted only the most cursory examination of the mammoth establishment, and yet, although unduly hurried, there was time enough to form an idea of the vast magnitude of the work there carried on and of the system in vogue.

The same day a stop was made at Johnstown, and the plants of the Cambria Iron Company, the Haws Silica and Fire Brick Works and the Johnson Company were examined. The local committee had prepared a very handsomely illustrated pamphlet descriptive of the several industries of Johnstown, extracts from which will be found on page 653.

At Pittsburgh.

The first international meeting of iron and steel manufacturers and engineers ever held in the United States took place in Pittsburgh, October 9 and 10. Members of the Iron and Steel Institute, the Verein Deutscher Eisenhuettenleute and of the American engineering societies took part in the proceedings. The matter presented at the two sessions was of great interest and value, coming as it did from this country, from England and from Germany, and illustrating, as it were, the practice in all. This permitted comparisons to be made and estimates to be formed of the value of each, and there is no doubt that this interchange of experiences will yield beneficial results. Further than this, in and about Pittsburgh were found practical examples of almost every branch connected with the manufacture of iron and steel, from the ore to the finished product. These served to illustrate in the best manner possible the subjects brought before the meeting.

Before the president, Sir James Kitson, opened the proceedings, John H. Ricketson, of Pittsburgh, on behalf of the local reception committee, welcomed the guests. He said, in part:

Mr. President, Pittsburgh numbers among its citizens a great inventor. I think that you will agree with me that the world owes its largest debt of gratitude for the safety of railway travel to two men now living—Sir Henry Bessemer, of Great Britain, and George Westinghouse, Jr., of the United States. The one gave us the steel rail, the other the air brake, both essential in heavy and rapid railway travel.

I should be remiss in my duty did I fail to regret the absence of our late fellow citizen, a native of Great Britain, to whose generosity this community is indebted for the magnificent building in which we are now assembled. Aided by his own exertions, his intelligence, indomitable energy, nerve and pluck and wisdom in the selection of his staff, he has raised himself, as our president said the other day in New York, to the acknowledged position of the largest manufacturer of iron and steel in the world, and no sooner was his foot firmly planted on the vantage ground of an almost unprecedented success than he declared it not only his pleasure but his duty to give to his native town, to the capital of his native land, to the two cities of his adoption here in Pennsylvania, and to other places almost too numerous to mention, monuments of public spirit in the form of costly and enduring structures which shall remain for centuries to come the home of literature, science and art.

Perhaps a word as to where we are will not be out of place. We sit in the gateway of the great West, as the newspapers are fond of calling the vast section of country between the Allegheny Mountains and the Pacific Ocean. Pittsburgh is situated 750 feet above the level of the sea at the foot of the western slope of the Alleghenies, within the water shed of the Mississippi Valley, 444 miles from New York, 150 miles south of the nearest port on Lake Erie, whence our ores come to us from from Lake Superior and thence reach us by rail. The city was laid out in 1765, on the site of the old French Fort Duquesne, so famous in colonial history, and on its capture by the British the name was changed to Fort Pitt, in honor of your great statesman, William Pitt, from whom our city derives its name. Time will only permit me to add that almost within the city limits the unfortunate General Braddock laid down his life in defense of the British flag, and with him a young American civil engineer from Virginia, George Washington by name, received his baptism of fire and won his spurs. Now, gentlemen, a word as to Pittsburgh as it is.

PITTSBURGH INDUSTRIES.

We have 21 blast furnaces, which in 1889 produced 1,293,435 tons of pig iron; 33 rolling mills, 27 of which roll steel, and their production in 1889 was 1,105,573 net tons of steel and 638,450 tons of rolled iron. Our annual capacity of steel rails is at present 550,000 tons. Our product of wrought iron pipe this year will, I am informed, not fall short of 350,000 tons, while our output of structural iron and steel will be fully 165,000.

We have 49 iron foundries, representing a capital of nearly $10,000,000.

The principal electrical industry in Pittsburgh is an apparatus for incandescent lighting. Of the dynamos in the United States having a capacity for the supply of current for 1,500,000 16 candle power lamps, Pittsburgh alone has furnished 650,000, or nearly 44 per cent. We have 15 firms or companies making window glass, 37 making flint and lime glass and 15 making green and black glass bottles, besides our great plate glass works.

The 15,000 coke ovens in this district consume 9,000,000 tons of coal in making their product of about 6,000,000 tons of coke.

In 1889 in round numbers we shipped to Southern markets, by river, 4,000,000 tons of coal; to Eastern markets, by rail, 2,500,000 tons; by rail, for reshipment by lake, 1,000,000; railroads entering Pittsburgh used 1,000,000 tons; we shipped by rail to Northeastern markets 500,000; we used for home and miscellaneous trade 2,000,000, making a grand total of 20,000,000 tons, or 60 per cent of the output of bituminous coal in Pennsylvania.

The railway tonnage of Allegheny County, of business originating here, exclusive of what passes through, is 20,000,000 tons per annum, or a fraction over 3 per cent. of the total railway tonnage of the United States, which amounted in 1889 to 619,137,237 tons.

Now one word as to natural gas. I am officially informed that in this district 750,000,000 cubic feet of gas are delivered to consumers each day through 1125 miles of pipe to our mills and factories, and to upward of 30,000 private warehouses, stores, hotels and dwellings. The present annual displacement of coal by natural gas is estimated at about 8,000,000 tons.

There are from 46,000 to 50,000 oil wells in the United States, and these figures are furnished me by one of the higher officers of the largest oil company in the world; and they produce on an average 130,000 barrels of oil per day, representing a capital of $120,000,000. The district including Western Pennsylvania, West Virginia and Southeastern Ohio produces 85,000 per day and Allegheny County 10 per cent of the latter amount.

There are 10,000 miles of pipe lines for the transportation of crude petroleum, involving a capital of $50,000,000. The stock in tanks at present of crude petroleum, is 26,500,000 barrels. The country has a refining capacity of 140,000 barrels per day for illuminating oil; 15,000 barrels per day are used for fuel purposes, and the amount is rapidly increasing.

Now, gentlemen, when we think that since 1876 there have been taken from the soil of Pennsylvania upward of 300,000,000 barrels of oil, and that she is producing to-day 2,500,000 barrels per month; when we remember that in addition to the oil taken from her soil 30,000,000 tons of bituminous coal and 35,000,000 tons of anthracite coal are taken, and then when we think that the State produced last year within a small fraction of one-half of all the pig metal made in the country, and more than one-half of all the steel and iron rolled in the country, you may form some conception of the immeasurable and boundless, though then hidden, resources of that princely domain of 44,500 square miles which King George II ceded to the Penns in satisfaction of a claim against the British Government of £16,000.

Mr. President, naturally from the character of our industries and avocations we appreciate more fully than the rest of the country the importance, the significance and the far-reaching consequences of your visit to America. We more than most of our countrymen are familiar with the history, the objects and achievements of the Iron and Steel Institute of Great Britain, the highest metallurgical authority in the world. You number among your members not only scientific men of universal reputation, but great capitalists, great captains of industry; the Knights of Labor, gentlemen, in the true sense of those words. And on your rolls are those who, from a long line of distinguished ancestors, are by inheritance the possessors and the guardians of some of the most honored names in English history. In the journals of your Institute is chronicled every step in the great march of the material forces of modern civilization for nearly a quarter of a century. Organized in 1869, your Institute this year attains its majority, and we esteem it a privilege and an honor to unite with you in celebrating the event on American soil.

Mr. President, more than 2000 years ago a Hebrew sage, in the spirit of prophecy, the fulfillment of which we are witnessing to-day, uttered these words, which in this presence seem like a benediction:

Every carpenter and workmaster that laboreth night and day, . . . the smith also sitting by the anvil and considering the iron work, the vapor of the fire wasteth his flesh

and he fighteth with the heat of the furnace; the noise of the hammer and anvil is ever in his ears, and his eyes look still upon the pattern of the thing that he maketh.

He setteth his mind to finish his work and watcheth to polish it perfectly.

So doth the potter, sitting at his work and turning the wheel.

All these trust to their hands and every one is wise in his work.

Without these cannot a city be inhabited. They shall not sit on the judge's seat, nor understand the sentence of judgment, and they shall not be found where parables are spoken.

But they will maintain the state of the world and all their desire is in the work of their craft.

The President's Address.

Sir James Kitson said: By the courtesy of the president and council of the American Institute of Mining Engineers I have been invited to take the chair and to open the proceedings of this congress. It is a graceful compliment to those members of the Iron and Steel Institute who are your honored guests at this moment—an acknowledgment of high consideration for scientific services rendered to a great industry by the Iron and Steel Institute, and a mark of distinction conferred upon the president of that Institute.

THE WORLD INDEBTED TO ENGLAND.

Our Institute is not exclusively British. In truth it is cosmopolitan, having enrolled on its list of members distinguished metallurgists of the United States, Germany, France, Sweden and Russia.

The birthplace and the headquarters of the Institute are in England. It will, therefore, I hope, not be considered in any way presumptuous if I ask you for one moment how much the world is indebted to my native land for the vast benefits which mankind has received from its engineers and manufacturers of iron and steel.

The inventions of Watt and Trevathick, the development of the steam engine, with all its consequential powers, the construction of the locomotive and the creation of the railroad by Stephenson, are directly the work of England and of Englishmen.

The puddling furnace of Cort and his method of rolling the puddled blooms in grooved rolls produced wrought iron in quantities and at a cost hitherto unattainable. Through these inventions South Wales became the seat of the rail trade, and it was enabled for many years to dominate and control the rail trade of the world.

The hot blast process of Neilson, patented in 1828, secured a great economy of fuel and a large increase of production. It entirely changed the condition of the pig iron manufacture and was truly ranked by Mushet as "a means of developing the national wealth of equal value with Arkwright's invention of cotton spinning."

Nasmyth's steam hammer gave the means of forging iron, which led to rapid developments and improvements in the applications of iron. The reversing rolling mill engine of Ramsbottom has been invaluable in the rolling of plates and bars of great dimensions.

The forging press, too, has been designed and improved by English inventors, to whom the world owes much for other mechanical appliances, devised to meet the various wants of the Bessemer process and the treatment of massive iron and steel.

To you probably the most important invention of modern times has been that of Sir Henry Bessemer. It has given you a material in quality and quantity for your railroads which it was a physical impossibility to obtain by the ancient methods of iron making. It is no exaggeration to say that without the Bessemer process for steel rail making the present railway system in the United States would not now exist; and the settlement of the new lands you have peopled, and the binding together of the vast territory between the Atlantic and Pacific under one civilized power, would not yet have been effected.

Sir Henry Bessemer has been kind enough, at my request, to prepare, for communication to this meeting, an account of his discovery of the process for manufacturing what is known as Bessemer steel; and some history of his investigations, and the way in which step by step he overcame the difficulties he met with, and finally dispersed in his developments of his remarkable invention.

This communication from Sir Henry Bessemer, which I will now read, will be given to you afterward.

SIR HENRY BESSEMER'S ACCOUNT OF THE DISCOVERY OF THE BESSEMER PROCESS.

DENMARK HILL, September 10, 1890.

DEAR SIR JAMES KITSON:

It is with great pleasure that I accede to your request to furnish you with a brief outline of the circumstances which led to the invention of my steel process—the more so on account of the generous interest you have always taken in the invention, notwithstanding that it aims at the overthrow of the older methods of producing malleable iron, in the production of which you have obtained so distinguished a position.

At the time of the Crimean War I invented a mode of firing elongated projectiles from a smooth bore gun, the rotation necessary to insure their proper position during flight being obtained by utilizing a portion of the powder gas to produce rotation by reaction, after the manner of producing rotation in turbines, and not by the rifling of the gun, consequently rendering all smooth bore guns at once suitable for firing elongated shot or shell. I of course offered this plan to our own Government, but it was discarded without a trial.

A little after this period I happened to be on a visit for a week or two with Lord James Hay at the house of his daughter in Paris. During this visit our host gave a farewell dinner to General Hamlin and several other distinguished officers in the French army, who were going out to the Crimea.

Among the guests on this occasion was Prince Napoleon, and while taking a cigar in the library after dinner the conversation turned naturally enough on artillery, and I then mentioned my system of firing elongated projectiles from smooth bore guns. The Prince was so impressed with the importance of this idea that he said he was sure that his cousin the Emperor would be much pleased if I would explain my invention to him, and that he would get an appointment made with the Emperor for this purpose. This was done, and I had a long and most interesting discussion with his Majesty, whom I found most thoroughly conversant with the whole subject of artillery.

His Majesty, in the kindest possible way, gave me a *carte blanche* to make any experiments I desired at Vincennes. A great many 30-pounder elongated projectiles were made, and were fired from a 4½ inch 12-pounder smooth bore cast iron gun at the Polygon at Vincennes. They were fired through a succession of thin wooden targets placed 100 m. apart, through all of which they cut circular holes, thus showing that they went end on. A thin coat of black Japan had been purposely put on them, and when the shots were recovered from the bank in which they were lodged the coat of japan was seen to be partially scraped off in spiral lines, caused by their passage through the wooden target; the angle of these scratches being carefully taken showed that from 1½ to 2¼ rotations had taken place in the length of the gun.

After many hours' practice on a cold December day we retired to the officers' quarters in the old fortress of Vincennes, and while standing round a blazing wood fire, sipping some hot spiced wine, Commandant Minie (the inventor of the rifle), observed that, "although the rotation of the shot was effected, unless we had something better to make our guns of, such heavy elongated projectiles could not be used with safety." This casual observation was the spark that has kindled one of the greatest industrial revolutions that the present century has to record, for during my solitary ride in a cab that night from Vincennes to Paris I made up my mind to try what I could do to improve the quality of iron used in the manufacture of guns.

My knowledge of iron metallurgy was at this time very limited, but this was, in one sense, a great advantage to me, for I had very little to unlearn, and so could let my imagination have full scope. After many months of trial and much building up and pulling down of reverberatory furnaces, I cast a small model gun; the iron was very white, and in turning it little short curly shavings were cut off. It was wonderfully tough for cast iron, but wonderfully brittle if classed as wrought iron. The little model gun looked very beautiful when highly polished, and I took it over to Paris and begged the Emperor to accept it as the first fruits of my studies of the metallurgy of iron. He expressed himself much pleased with it, and complimented me on having achieved a step in the right direction, and, with his own hands placed it in a bureau, saying: "Some day it may become an interesting relic."

About this period I began to fully appreciate the fact that if I could improve cast iron and render it malleable and still retain its fluid state, apart from its use for artillery, it would be of the greatest commercial value for all engineering purposes. I therefore pursued my experiments with greater ardor than ever, for I was convinced that I was on the eve of producing a quality of metal that would supersede wrought iron.

At this time I devoted myself exclusively to these investigations, which were very costly, and I became most anxious to obtain the opinion of some able engineer as to the value of my invention, lest I might be deceiving myself, and living in a fool's paradise.

I consequently consulted George Rennie, the eminent civil engineer. I showed him a small upright fixed cylindrical converter, and in it we made a charge of 7 hundredweight of Blaenavon pig iron into an ingot of malleable iron. Mr. Rennie was in raptures with the result, and said: "You must not keep this light under a bushel for a single day longer; and, by the bye, there is a first-rate opportunity for you. The British Association meet at Cheltenham next Tuesday; read a paper there, by all means. I am president of the Mechanical Section. It is true all papers are arranged, but if you will write a paper I will take the responsibility of putting it first on the list." He kept his promise, and I read my paper "On the Manufacture of Malleable Iron Without Fuel," which appeared *verbatim* in next day's *Times*.

The entire iron trade of the kingdom was startled by the facts detailed in this paper, backed as they were by two small bars of malleable iron, one of which had been piled and rerolled; a few days later the iron masters came trooping up to London to see the new process. There are many interesting incidents connected with these visits which I cannot trespass on your time to relate, but some idea of the excitement may be gathered from the fact that, notwithstanding the imperfect state of the process at that time, I was actually paid £27,000 for licenses granted within one month of the reading of my paper. At many iron works the managers set to work to test the invention in the rudest possible manner with such means as they had at their disposal, all of which attempts were failures. In my experiments I had used Blaenavon pig iron, which was successful, and at that time I had no idea that other brands of iron would fail in the manner they did. No sooner were these failures known than an extraordinary revulsion of feeling was manifested, and the most perfect distrust of the invention became universal. The public press, which had spoken of it in such glowing terms, now condemned it as impracticable, and spoke of it as "a brilliant meteor that had flitted across the metallurgical horizon, dazzling a few enthusiasts, and then vanishing forever in total darkness."

Prior to this invention pure malleable iron in a fluid state was wholly unknown; indeed, whole days of exposure to the most powerful

furnaces then in use entirely failed to bring this material into a state of fusion, notwithstanding which I proposed to convert ordinary melted cast iron into this malleable fluid state in quantities of 5 tons at a single operation, and in the short space of 15 minutes, by the mere chemical action of cold atmospheric air, and in the entire absence of any fuel whatever, except that which existed in the form of carbon and silicon in the crude metal itself. It is not surprising, therefore, that the iron masters, as well as the whole press, joined in one general condemnation of what they then believed to be a perfect chimera, which none but a wild enthusiast could have ever believed to be possible. I knew far otherwise, but this was no time to argue the question. Words would have been of no avail, so I set earnestly to work to try and master the difficulty that had so unexpectedly arisen; this was no easy task.

All the old investigations had to be gone over again; experiments on a much larger scale, with larger and more powerful machinery, were found necessary; but the difficulties to be surmounted had reference more to chemical than mechanical questions. A laboratory was therefore fitted up, and I engaged the services of a professor of chemistry, at a high salary, to make an analysis of all the iron and the materials employed in our experiments, as well as a systematic analysis and classification of all the results obtained. The very large scale on which these operations were carried out involved a considerable outlay in various ways, but there was no slackening of exertions, no cessation of the severe mental and bodily labor. In this way another long and weary year had passed, and but little real progress had been made toward the removal of the difficulty. Many new paths had been struck out, but they had led to no practical results. Several weeks were sometimes necessary to make and fit up the apparatus required to test each new theory as it was formulated, and it too often happened that the first hour's trial of the new scheme dashed all the high expectations that had been formed, and we had again to retrace our steps. Thus week after week went on amid a constant succession of newly forged hopes and crushing defeats, varied with occasional evidences of improvement. I however, worked steadily on. Six months' more of anxious toil had glided away, and things were much in the same state, except that many thousands of pounds had been uselessly expended, and I was much worn by hard work and mental anxiety. The large fortune that was almost within my grasp seemed now far off; my name as an engineer and inventor had suffered much by the defeat of my plans. Those who had most feared the change with which my invention had threatened their long vested interests felt perfectly reassured, and could now safely sneer at my unavailing efforts; and, what was far worse, my best friends tried, first by gentle hints, and then by stronger arguments, to make me desist from a pursuit that all the world had proclaimed to be utterly impossible; it was indeed a hard struggle, and I had well nigh learned to distrust myself, and was fain at times to surrender my own convictions to the mere opinion of others. Those most near and dear to me grieved over my obstinate persistence—but what else could I do? I had the most irrefragable evidence of the absolute truth and soundness of the principle on which my invention was based; and with this knowledge I could not persuade myself to fling away the promise of wealth and fame, and lose entirely the results of years of labor and mental anxiety and at the same time confess myself beaten and defeated. Happily for me the end was nigh, and in a few more months I had fully succeeded in producing steel worth £50 to £60 per ton from charcoal pig iron which had cost me only £7 per ton, the conversion of the crude iron into steel being effected by simply forcing minute streams of cold atmospheric air upward through it for a space of 15 minutes.

Thus was the so called fallacious dream of the enthusiast realized to its fullest extent, and it was now my turn to triumph over those who had so confidently predicted my failure. I could now see in my mind's eye at a glance the great iron industry of the world crumbling away under the irresistible force of the facts so recently elicited. In that one result the sentence had gone forth, and not all the talent accumulated during the last 150 years, of all the thousands whose ingenuity and skill had helped to build the mighty fabric of the British iron trade—no, nor the millions that had been invested in carrying out the existing system of manufacture, with all its accompanying powerful resistance—could reverse that one great fact or stop the current that was destined to sweep away the old system of manufacturing wrought iron and establishing homogeneous steel as the material to be in future employed in the construction of our ships and our guns, our viaducts and our bridges, our railroads and our locomotive engines, and the thousand and one things for which iron had hitherto been employed; and yet, with all this newly developed power, I was paralyzed for the moment in face of the stolid incredulity of all practical iron and steel manufacturers, which stood like the solid wall of a fortress, barring my way to the victory I had already won. I announced the fact of my complete success to the world, and held in my hands the most undeniable proofs of the truth of my assertion, but no one would now believe it possible. They remembered but too well the great expectations that were excited two years previously by the first announcement of my invention at Cheltenham, and were not again to be disturbed by the cry of "Wolf." Thus it happened that, after the hard battle I had fought for so many years, I found myself as far as ever from the fruits of my labor, for not a single iron master or steel manufacturer in Great Britain could be induced to adopt the process.

Anxious to possess still further practical proofs of the value of my invention, I made a few hundredweight of steel bars, at my experimental works in St. Pancras, of all the sizes and special qualities required in an engineer's workshop. These I took to the works of my friends, the Messrs. Galloway, engineers, of Manchester; and, unknown to any of their workpeople, these bars were given out and employed for all the purposes for which steel had hitherto been used in their extensive business. So identical in all its essential qualities was this steel with that usually employed by their workmen that during two months' trial of it not the slightest idea or suspicion that they were using steel made by a new process was ever entertained by them—in fact, they were accustomed to use steel of the best quality, costing £60 per ton, and they had no doubt whatever but that they were still doing so.

I may here remark that this tool steel was made from Swedish charcoal pig iron, costing, delivered at Sheffield, £7 per ton, and it was with this high class raw material that our firm continued for about two years to manufacture tool steel for engineers, for which we obtained £44 per ton, and with which such firms as Sir William Fairbairn, Sir Joseph Whitworth, Messrs. Sharp, Sewart, &c., were regularly supplied up to the time when larger and more profitable work had made it not worth our while to continue the manufacture of tool steel. Indeed, so satisfied were Messrs. William and John Galloway with the crucial test of our tool steel at their works that they entered into partnership as steel manufacturers with myself, my partner Robert Longsden, and my brother-in-law, Mr. Allen.

We built a steel works in the town of Sheffield, determined to beard the lion in his den, and to undersell the trade until we forced them in self-defense to take a license under my patents and carry on my process. We at once got to work and dropped £10 per ton on railway tires, &c. This soon brought the trade to a proper frame of mind. Sir John Brown & Co. applied for a license; this was soon followed by Messrs. Charles Cammell & Co., and licenses were also granted to many other firms. Of course we thus created a strong rivalry with our own firm, and forced our own prices down; this we were fully prepared for, as it still left a very large margin of profit.

Some idea may be formed of its importance as a manufacture when I state the simple fact that, on the expiration of the 14 years' term of partnership of our Sheffield firm, the works, which had been greatly increased from time to time entirely out of revenue, were sold by private contract for exactly 24 times the amount of the whole subscribed capital of the firm, notwithstanding that we had divided in profits during the partnership a sum equal to 57 times the gross capital; so that, by the mere commercial working of the process, apart from the patent, each of the five partners retired after 14 years from the Sheffield works with 81 times the amount of his subscribed capital, or an average of nearly cent. per cent. every two months—a result probably unprecedented in the annals of commerce.

Yours faithfully,

HENRY BESSEMER.

Now, gentlemen, I asked Sir Henry Bessemer to write this out in his own handwriting; and this account in his own handwriting I think I cannot do better than to hand over to the American Mining Institute and ask them to place this account of the early struggles of Sir Henry Bessemer among the archives of that society.

The Siemens-Martin process of the manufacture of open hearth steel met with its greatest development in England, and it has enabled us to produce a material suitable for the requirements of the shipbuilder, of which he has availed himself to a vast extent.

In Great Britain the production of Bessemer steel ingots in 1889 was 2,140,791 tons; of open hearth steel ingots, 1,429,169 tons. We in Great Britain and Ireland are justly proud of our mercantile marine. The supremacy of our ship building and of our shipping interests is based upon the excellent quality and an abundant supply at a moderate price of steel furnished by our steel makers.

The demands of naval architects and marine engineers have been responded to with intelligence and enterprise. Plates, frames, shafts, forgings, steel castings of forms and dimensions thought impossible but a few years ago, have been manufactured at low prices. These productions have enabled our naval architects to design, and our builders to construct, the magnificent ships which are the pride of our navy and our mercantile marine.

The strength of our position and the remarkable economy of this important industry can be best demonstrated to you by a fact within my own personal experience. I have, within the past two months, as chairman of a shipping company, entered into contracts for the purchase of several new first-class cargo steamers, to be built of steel, of the most approved design, with triple expansion engines, at the cost of £7 per ton registered tonnage. These ships, of a carrying capacity of 4000 tons, will be built and afloat within seven months of the laying of the keel.

The alloys of steel with other metals continue to be the subject of research and experiment. Many of our members have devoted earnest attention to this fruitful field of inquiry. Communications by Mr. Riley, Mr. Hadfield, M. Osmond and M. Brustlein, who is with us, and others, will shortly come before the members in papers or notes in the Transactions of the Institute.

The remarkable success which has rewarded the researches of inquirers and experimenters on the alloys of steel with chromium, tungsten, aluminum and nickel gives us good reason to stimulate our members to continue their exploration of this field. Among those alloys the most important results appear to have been obtained from the use of nickel as an alloy of steel.

It will be remembered that when James Riley's valuable communication on the subject of alloys of nickel steel was read before the Iron and Steel Institute

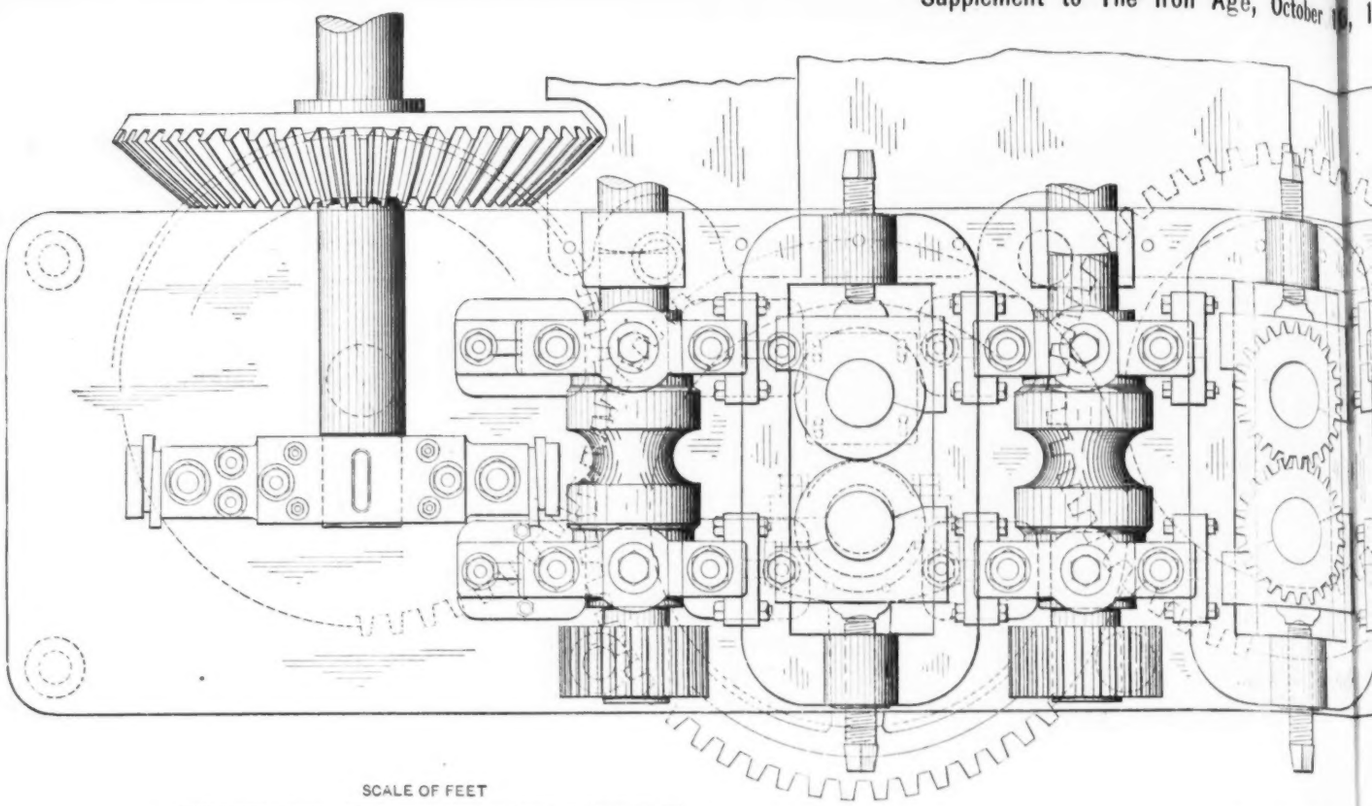


FIG. 1.—PLAN.

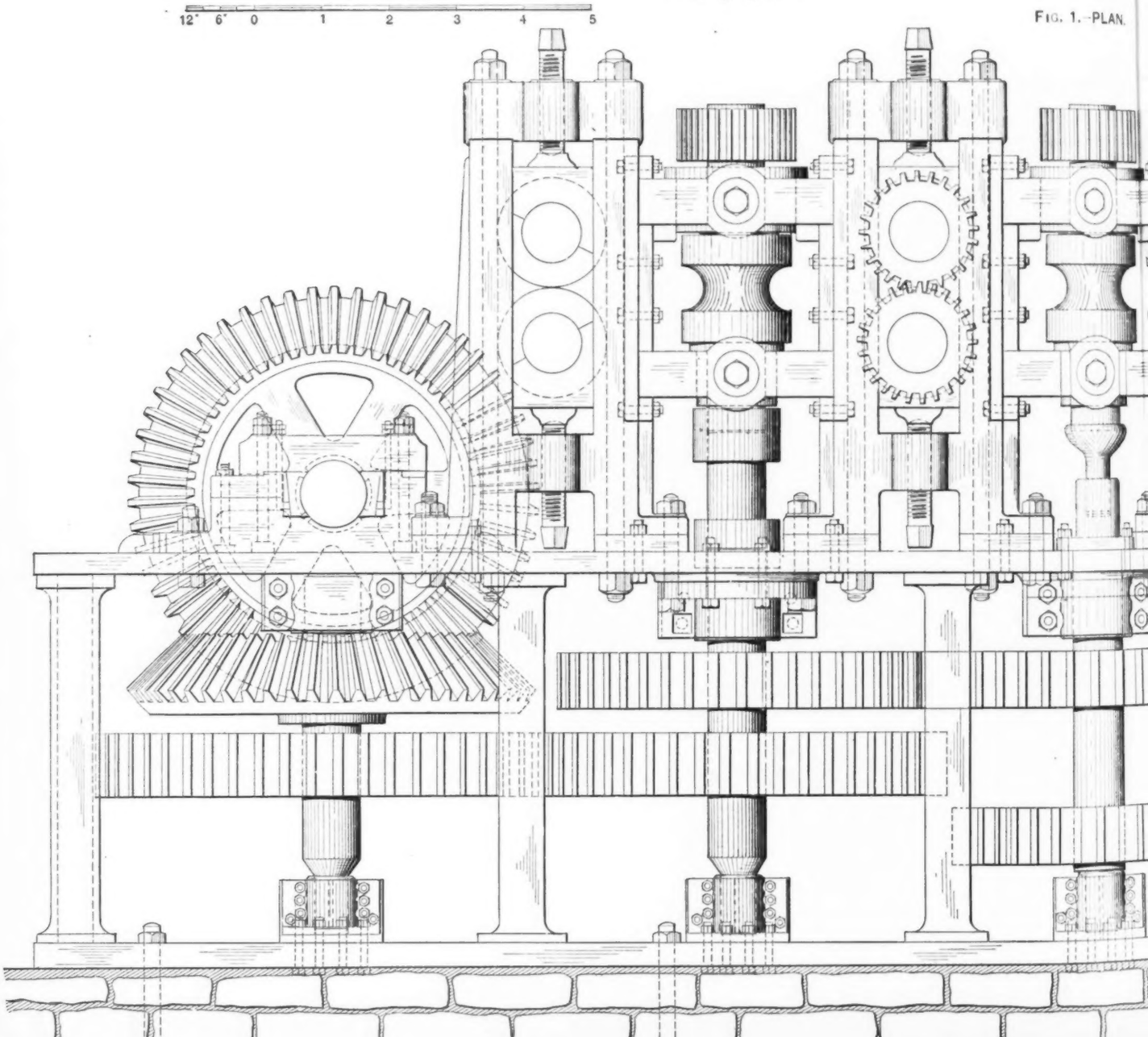
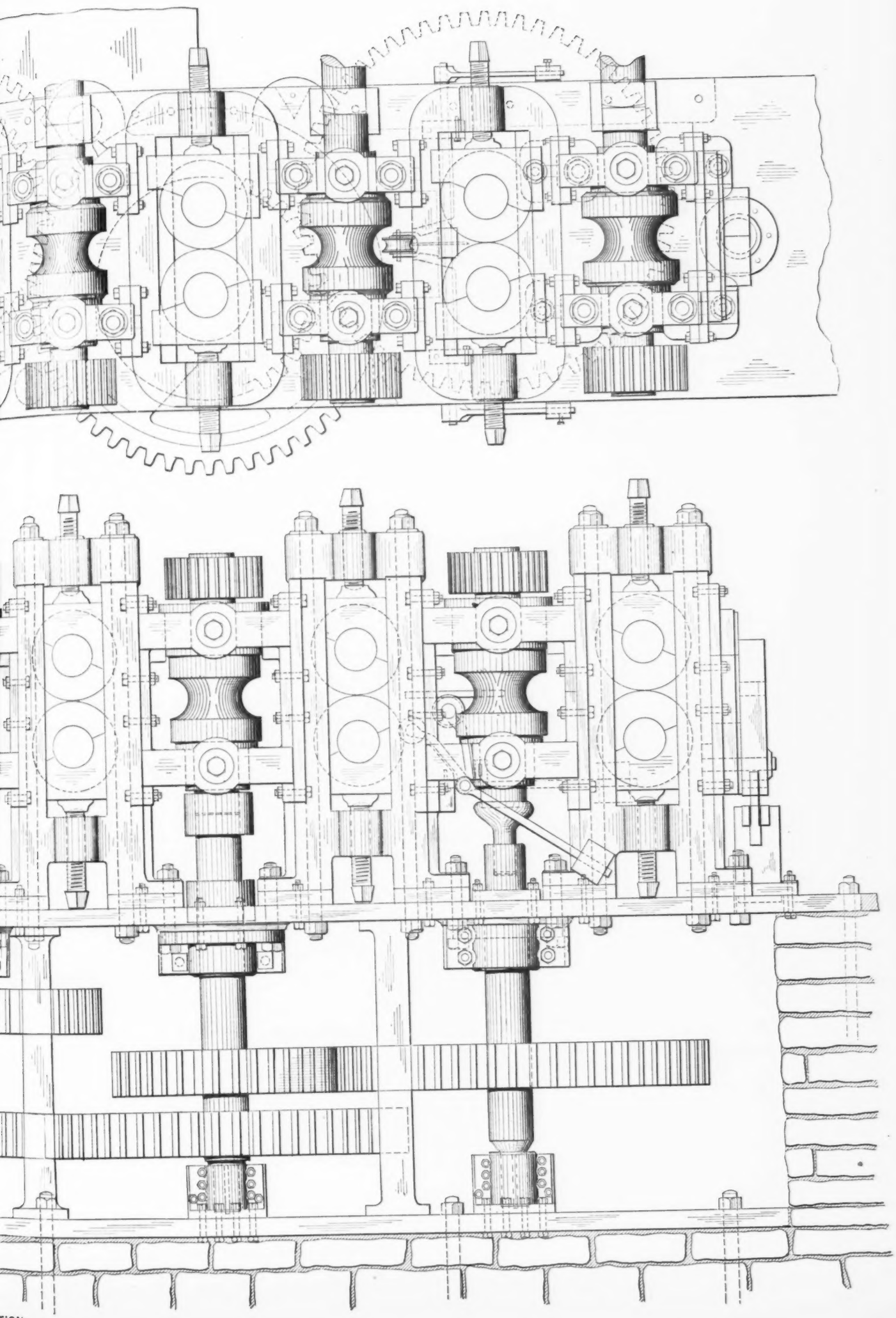


FIG. 2.—ELEVA

THE KELLOGG MACHINE FOR ROLLING



TION.

SEAMLESS PIPE FROM HOLLOW INGOTS.

meeting in May, 1889, J. F. Hall, of Messrs. William Jessop & Sons, Sheffield, at once rose and laid the claim to priority of invention, informing the institute of the innumerable experiments he had been making with alloys of nickel and steel during several years past. Since then continuous experimental research has been made into this matter. Under the superintendance of Mr. Hall, armor plates have been manufactured from this material and tested by English Admiralty officials, giving results which rank about 75 per cent. above any similar plates ever tested in England. During the same period Messrs. Schneider & Co., of Le Creuzot, France, have furnished nickel steel armor plates which have been tested by the French, Danish and Chilian Admiralty authorities, with results almost identical with those obtained by Mr. Hall. Within the last month a nickel steel armor plate of Mr. Schneider's manufacture has been tested in the United States and has given similar results. At the present time Mr. Hall has under course of manufacture breech loading ordnance cannons and projectiles for the English War Office, and he has already applied it in the production of rifles and sporting gun barrels, boiler tubes for torpedo boats, telephone and telegraph wire. When it is considered that nickel steel can be made in various tempers, giving tensile strain of 107 tons per square inch, with an enlongation of 3 per cent. in 8 inches; 97 tons tensile with an enlongation of 7 per cent.; 50 tons tensile with an enlongation of 45 per cent., it is impossible to foresee to what uses this most remarkable material may not be put; and now that the various patents and interests owned by J. F. Hall, of Sheffield, W. H. Marbeau, of Paris, William H. Schneider, of Le Creuzot, and James Riley, of Glasgow, have been associated, their joint labors promise to give rapid development to this interesting alloy. Works have already been erected by this association in France for the special manufacture of ferro nickel, and will shortly be followed by others in England and in the United States of America.

The treatment of large masses of steel by tempering, hardening and annealing in water, oil or molten lead has been carefully studied, but the secrets of the behavior of masses of steel in heating and cooling are yet far from being unfolded. M. Osmond, in his excellent paper delivered before the International Congress in Paris last year, points out that tempering in oil was known to the ancients—being mentioned by Pliny; and Shakespeare also knew that the Moors had the knowledge that different temperatures of water effected the results of the hardening process. Othello says: "I have another weapon in this chamber; it is a sword of Spain, the ice brook's temper." One day, in conversation with Mr. Gladstone, I related this to him. He at once capped the quotation by saying that: "Yes, and I remember that Homer, in the Odyssey, says, 'As when the smith dips into cold water a great axe or adze, and it hisses loudly as he is tempering it, for so it is that iron is made hard.'" (Odyssey ix, 391-4.)

The first paper, by Sir Lowthian Bell, of Middlesborough, England, was on the

Probable Future of the Manufacture of Iron.

In accordance with the idea that any estimate of what is going to happen must be founded on what has already taken place, the author first deals with the history of the iron trade. He shows the almost complete displacement of puddling furnaces in Great Britain since the discovery of the Bessemer process. He then considers the direct process, and whether it will ever be a rival to the united power of the blast furnace and the Bessemer converter. He contrasts the present methods with those of a system intended to obtain wrought iron and steel by direct treatment. Before touching this subject he made the following remark:

COSMOPOLITANISM OF THE IRON AND STEEL INSTITUTE.

Let me here remind you, although we are guests upon the present occasion, and Great Britain is the birthplace and home of the Iron and Steel Institute, its name and constitution were intentionally adopted so as to exclude geographical boundaries from being any limit to the scope of its operations. Accordingly, these cosmopolitan intentions have been followed by our numbering in our ranks considerably above 200 members belonging to other countries, and of these nearly one-half are inhabitants of the United States. This union between members of one great family is a subject of sincere congratulation to the founders of the body, and, I feel sure, is not without interest to those who have joined it from the Continent of Europe.

While considering whether a useful lesson might not be learned from this retrospect of our trade, particularly by members of our Institute of less advanced years, reports reached me from opposite quarters of the globe of the so-called "direct process" beginning again to find favor in the minds of gentlemen well qualified to express an opinion on a scheme which, if successful, would be a rival to the united power of the blast furnace and the Bessemer converter.

The great advantages possessed by the present mode of treating the ores of iron are too well understood to render it necessary that the blast furnace should occupy our attention at any length upon the present occasion. These, therefore, will only be spoken of in order to contrast them with those of a system by which it is intended to obtain wrought iron and steel by the direct treatment. In doing this, it will be made apparent that the blast furnace is able to perform a duty which has never been approached by any other form of apparatus—viz., the complete reduction of the metal contained in the ore.

Many eminent metallurgists have regarded with favor the principle contained in a variety of the processes known as "direct," and it must be admitted that there is in the idea a simplicity as compared with the present mode of manipulation which is highly attractive. In the latter the iron from the blast furnace has been made to unite with certain metalloids, we knowing at the same time that, in order to render the product malleable, these substances have to be removed. Among those who have labored in this field, not the least distinguished was my late friend, a former president of this institute, Sir William Siemens. In the hope of solving a problem in which his predecessors had not been successful, he spared neither time nor money. Ritter von Tunner, a high authority in all things connected with iron, has, in our frequent correspondence on such matters, extending over many years, expressed himself at one time hopefully on the direct process. In a recent communication, however, he seems to have abandoned all expectation of its being able to compete with the combined forces of the blast furnace and the Bessemer process. On the other hand, so far as I know, Siemens died believing in its future success.

THE PRESENT METHODS.

I have elsewhere endeavored to prove that reduction is not exclusively effected in the so-called reducing zone of the blast furnace; on the contrary, that oxygen, amounting to about 25 per cent. of its original quantity, arrives at or near the tuyeres, combined with iron in the form of some suboxide. Further, that final deoxidation of this suboxide is probably effected by a quantity of carbon, generated by a dissociation of carbonic oxide, as expressed by the formula $2CO = C + CO_2$. This reaction is inferred from the result of numerous experiments in the laboratory and from repeated observation at the furnace itself, confirmed by the fact that the gases at the tuyeres contain a quantity of oxygen, about 2 hundredweight per ton of metal produced, and something like 1½ hundredweight of carbon; the former not being accounted for by the atmospheric air used, nor the latter by the weight of fuel burnt in the hearth. Whether it is the actual carbon precipitated from the carbonic oxide or coke itself which completes reduction or not, in a heat-producing point of view, is immaterial; what seems proved is that it is reserved for the crucible to complete this work at or about the period when fusion takes place.

As a theoretical proposition we have been reminded that the exact quantity of carbon required to deoxidize 20 hundredweight of iron, in the form of ferric oxide, is 4.38 hundredweights. It is further assumed that this mixture of ore and carbon must be raised to a temperature of 800° C., for which, provided the entire carbon used is burnt, half to monoxide and half to dioxide, 1.27 hundredweights ought to suffice. It is suggested not that the work can be done for these 5.65 hundredweights, but that they are the limits toward which we may work.

We will imagine, as indeed has been proposed, that the operation is carried out in the furnace used by Siemens, which was one of the reverberatory type, constructed on the rotating principle. As bearing immediately on this question, it may be mentioned that after a vast number of experiments I arrived at the conclusion that the following temperatures may be regarded as those which are required for setting up the actions given in the subjoined table:

	C.	F.
CO, carbon monoxide commences to reduce calcined Cleveland ore at..	210°	410°
C, carbon commences to reduce calcined Cleveland ore at*.....	399°	750°
CO_2, carbon dioxide commences to oxidize spongy iron.....	426°	800°
CO_2, carbon dioxide expelled from limestone.....	538°	1000°
CO_2, carbon dioxide commences to dissolve carbon.....	815°	1500°

It must be understood, however, at the temperatures named, that the action goes on but slowly, which action, however, speedily increases as the heat is raised.

Returning for a moment to the blast furnace, we have in the crucible the zone of greatest heat, fusion of the slag and iron, and removal of the last portions of oxygen from the iron. During the next 40 feet in hight the chemical changes are insignificant, that portion of the interior being almost entirely utilized by the descending materials absorbing the heat contained in the gases and returning it to the hearth. At a distance of 60 feet from the hearth the carbon dioxide is given off from the limestone, where the temperature, as a rule, suffices for this gas to dissolve carbon, and thus prevent its combustion at the tuyeres. Lastly, reduction in the upper zone is effected, where the temperature in a modern furnace ought never to be such as with good coke would permit the resulting gas acting on carbon ($CO_2 + C = 2CO$).

So far as my observations, experimental and otherwise, have enabled me to judge,

*Cleveland ore is specified because there are slight variations in the temperatures at which different ores are affected by CO.

the maximum quantity of oxygen representing the second equivalent in carbon dioxide in the gases is that corresponding with the equivalent contained in the ferric oxide of the ore. From this it might be inferred that reduction is completed in what has been generally known as the reducing zone—*i.e*, the uppermost and cooler portions of the furnace. We know, however, that the deposition of carbon, accompanied by the generation of some carbon dioxide, as already mentioned, is also most abundant at moderate temperatures. These facts might reasonably lead us to expect a quantity of carbon dioxide in excess of that due to the reduction of ferric oxide by carbon monoxide.

It will, however, be shown immediately that a condition of equilibrium in the gases is determined not alone by the relative quantities of the two carbon oxides, but also by the amount of oxygen still remaining in combination with iron. Now, the quantity of carbon required to be burnt at the tuyeres in order to fuse the slag and iron, added to that rendered necessary to reduce metalloids found in the pig, is such that, at the various temperatures through which the ore descends a position of equilibrium is reached when the gases contain at the outside about six hundredweight of carbon per ton of iron, in the form of dioxide, and when the metal still retains about one-fourth of its original quantity of oxygen.

This observation refers to ores of the type of Cleveland, but with those of a different character the composition of the gases may be materially modified. Thus, in certain Swedish countries the fuel consumed does not greatly exceed two-thirds of the quantity necessary for smelting the Cleveland ironstone. The volume of carbon monoxide for every ton of iron is correspondingly diminished, the result being that instead of having two volumes of this substance in the escaping gases for each volume of carbon dioxide, the two gases are found in almost equal volumes. In one respect, however, all furnaces agree—viz., in there being an increase of carbon and oxygen in the gases at the tuyeres, as compared with that found a short distance above this level.

Thus it will be seen that at no time during the descent of the ore in a properly constituted blast furnace is it, with one exception, ever exposed to a high temperature in an atmosphere of gases capable of oxidizing iron. The exception is when carbon monoxide is split up into carbon and carbon dioxide; and then the precipitated carbon serves, as has already been observed, to remove the oxygen taken up by the iron during the act of dissociation when the ore arrives at the tuyeres.

Now, it is not too much to say that the conditions of every reverberatory furnace are the very reverse of those just laid down. If coal is the fuel burned, which generally is the case, we have vapor of water, carbon dioxide and very often a good deal of free atmospheric air, heated probably at least to 1500° C., passing over the materials.* Thus exposed, spongy iron, when formed by direct reduction as proposed, could not fail to be very rapidly oxidized. But the circumstances under which it is now expected to produce spongy iron consist in burning half the carbon to dioxide and the other half to monoxide. From the information obtained in the table just given we learn that while carbon monoxide is a reducing agent, the product of reduction—carbon dioxide—is of an opposite character, and, in consequence, is able to reoxidize the metallic iron by the production of which it was generated. The cause which determines this reflex action is difference of temperature, and, as might be expected, when both gases are present there is brought about a position of equilibrium determined, as has been said, not by temperature alone, but also by the extent of the oxygen still remaining united with the iron.

Thus, if a mixture of two volumes of carbon monoxide and one volume of carbon dioxide is passed over calcined Cleveland ore at about 417° C., one-third only of the oxygen can be removed,—*i.e.*, the ferric is reduced to ferrous oxide. If, on the other hand, the gas consists in equal volumes of the oxidizing and reducing gases, the same effect is produced, provided the temperature is raised to a bright red; and spongy iron similarly exposed is oxidized, and becomes also ferrous oxide. At a white heat the attraction of the metal for oxygen is so intensified that further action ceases when 12 per cent. of the combined oxygen is removed from the ore. At the same time 10 volumes of carbon dioxide are able to keep in check the reducing power of 90 volumes of carbon monoxide.

THE DIRECT PROCESS.

I see no reason, however, why a close approixmation to complete reduction in the direct process should not be effected by using a sufficient quantity of carbon mixed with the ore in the manner already described. The difficulty to be apprehended is the reoxidation of the spongy iron when, by the revolution of the furnace, a fresh surface is exposed to the flame which is serving to heat the materials under treatment. Certain it is that Siemens failed to reduce the loss of metal to within reasonable limits. Forty-five years ago I labored for some time with William Neale Clay, who was very sanguine of being able to dispense wholly or partially with the blast furnace. The results in our case were the same as those obtained by others who have followed us in the same path since that time. As regards the carbon required as a source of heat for raising the temperature of the mixture of ore and carbon I see no prospect of reducing this with any approach to the quantity previously named—*i. e.*, 1.27 hundredweight per ton of iron. Not only theoretically, but practically, in the Bessemer converter, the combustion of the metalloids and a portion of iron suffices to raise the bath of melted cast iron to a proper temperature for keeping malleable iron in a state of fusion. Attempt the same thing in a puddling furnace, rotating or otherwise, and the oxidation of the same metalloids and iron, producing the same quantity of heat as in the converter, requires to be supplemented by the heat afforded by 15 hundredweight of coal, in each case commencing with iron in a fluid state. In both there is a great loss of heat at the chimney, but this we will neglect, and regard the remainder in each as due to radiation, convection, &c., inseparable from the larger size of the furnace and the small amount of work turned out as compared with Bessemer's apparatus.

If, however, we take the weight of a cubic foot of pig iron and contrast it with the same volume of the mixture to be employed in the direct process we are describing, the iron turned out, on such a mode of computation, will be about one-tenth of that obtained when pig iron is the raw material. To what extent the 15 hundredweight of heating coal per ton of iron will be increased by any such diminution in the yield of product it would be difficult to predict, but it is perhaps not necessary to pursue this branch of the inquiry at greater length in this place.

Up to this point the economy of the direct process has been argued upon thermal and chemical grounds, but the question of the capabilities of a reverberatory furnace, as compared with the united action of a blast furnace and a Bessemer converter, is perhaps best answered by the amount of labor required by the two systems. In an audience consisting largely of practical men I do not apprehend it will be denied that our present "indirect process" costs in wages, for the smelting and the Bessemer processes, less than one-half of that paid in converting pig into puddled iron; and probably we shall agree in supposing that if the reverberatory furnace should have to do the work of the blast furnace, this double cost may have to be doubled again.

In a locality where charcoal appears to cost 60/ per ton, and lignite 12/, but where ore very suitable for steel making is valued at 5/6, it is sought to neutralize the disadvantages of coal, dear and unsuitable for blast furnace work, by having recourse to a direct process. To carry out these views a highly carburized bath (*hochgekohltes Metallbad*) of pig iron is made in a Siemens furnace. To this molten pig melted or highly heated ore is added, by which the excess of carbon in the fluid metal reduces a corresponding portion of iron of the ore just added. The bath of metal is now to be restored to its pristine state of carburization by the addition of solid carbon, after which the slag formed is removed and more ore is to be added, and this alternate system of treatment is continued until the required quantity of steel is obtained.

The cost of 1000 kg., say 1 ton, of the steel produced by this modification of the direct process is thus stated by its author:

	£	s.	d.
Ore containing 52 and 54 per cent. of iron, but yielding 47.4 per cent. of steel.....2110 kg. at 5/6 =	0	11	0
Charcoal.....240 kg. at 60/ =	0	14	4.8
Lignite coal.....2000 kg. at 12/ =	1	4	0
Labor..... =	0	11	7.2
Repairs..... =	0	8	0
Carburizing the metal..... =	0	1	0
Total.....	£3	10	0

After what has been said I shall be surprised if an ore containing, say, 53 per cent. of iron, when reduced in such an oxidizing atmosphere as that to which it has been exposed in a Siemens furnace, will be found to yield 50 of steel.* The other expenses do not require criticism, because even upon the statement given above the weight of ore and coal used in this direct and single operation is greater than that consumed in the blast furnace and at the converter taken together; the labor is very much higher, and I apprehend that to the remaining item of "repairs" (8/) a considerable sum will have to be added for other expenses connected with the establishment. Further, it may be said that the abnormal conditions of the locality are not such as render the process one of general application, even if all the expectations entertained of it by the inventor were realized.

M. Chenot at the French Exhibition 45 years ago was awarded a *grande médaille d'or* for what M. Le Play, a scientific Frenchman of repute, declared to be "the greatest metallurgical discovery of the age."† In 1862 it was reported that 2000 tons per annum of bar iron were being made by it in the north of Spain, and I myself saw the process in operation there in 1870. It consisted in exposing a mixture of ore and charcoal in a close retort, heated from the outside, and was continued to be practiced some years subsequent to my visit, and it may be therefore inferred that time enough had been

* Of course it would be quite possible to maintain an excess of the reducing gas—carbon monoxide—in the furnace, but this merely means a great waste of fuel.

* It should be mentioned that in this particular case it is proposed to have the initial highly carburized iron made in the Siemens furnace itself or obtained elsewhere, most probably, I presume, from a blast furnace. As no pig iron is alluded to in the estimate of cost, it is taken for granted that the entire operation is conducted in the open hearth.

† Percy's "Metallurgy," page 335.

devoted to the question to have proved its commercial value or the reverse. It is now a considerable time since all trace of this discovery was swept away after having had a very prolonged trial. According to an account given by Dr. Percy there was a loss of 18 per cent. more ore in obtaining merchant bars than is incurred in the ordinary method of producing this form of malleable iron. The fuel consumed is about the same in both cases; but more than one-third of that used in the direct process being charcoal, the actual cost must necessarily be much the higher of the two.

M. Gruner, whose valuable labors on the metallurgy of iron have been universally acknowledged, gives a much more unfavorable account of the Chenot process.* According to him, the waste of metal (Fe) upon 1 ton of finished iron was 45 per cent., and the consumption of fuel amounted to 4 tons. This calculation does not appear to comprise the power for driving the machinery, so that 4½ tons would be the probable total weight of coal required per ton of finished bar iron.

The consumption of coal for the blast furnace and the Bessemer process on 1 ton of merchant steel does not exceed 2¾ tons, while the actual waste of iron (Fe), instead of 45 per cent., as in the direct process, may be taken at 15 per cent.

In addition to this serious waste of material, there are other inconveniences connected with the manipulation of the product. The iron sponge is so prone to oxidation that, when warm, its takes fire on exposure to the air—a property which compels it to be stored in close vessels. M. Gruner mentions eight days being thus required for reduction and cooling. If this be correct, sufficient appliances would have to be provided to hold about 2700 tons of the light sponge, in the event of it being desired to rival the production of one of the Edgar Thomson blast furnaces. Besides this, there will be the preparation of from 3500 to 4000 tons of ore per week, which has to be used of the size of hazel nuts.

A few years ago there existed among the mountains of Savoy a small blast furnace, making, upon the occasion of my visit, about 25 tons of iron in the week. The fuel was charcoal, and the blast was created by a small stream of water falling down a 12-inch square wooden box about 15 or 20 feet in hight. The water was received in a square closed cistern of wood by which the air carried down with the stream was separated from the water and driven into the furnace. This was the instrument, but of only half the power of that I saw working, which finally extinguished ages ago all the Catalan direct furnaces in almost every part of the civilized world.

In the year 1727 charcoal pig iron cost at Kidderminster £6. 5/ per ton, of which the ironstone cost only 30/, the weekly make being under 10 tons. To convert this into malleable iron in a Lancashire fire, as it is called, a further expenditure of £5 was incurred, bringiug up the total cost to £11. 5/. One hundred and sixty years after the date mentioned finds us in England bringing ore 1000 miles over sea, selling the pig iron made from it at little more than 40/, and disposing of steel rails made from the same pig at less than 75/.

CONCLUSIONS.

It is against the appliances which have enabled us to perform what may be regarded as a marvel of economy—against the blast furnace making 1000 and even up to 2000 tons in a week, and one or two Bessemer converters, as the case may be, turning the whole into steel as the metal runs from the furnace, that a process, which has practically made not one step in advance during the last 50 years, ventures in our day to wage war.

If there is a spark of vitality in this obsolete plan, what have our iron masters been about that they have not blown it into life? We have had, and have now, men among them who have distinguished themselves by the manner in which they have taken hold of every sound idea, scientifically propounded or otherwise, and insured its success, often beyond the most sanguine expectations of the most sanguine inventor. It may well be asked how it is that this direct process has, up to this time, ended in direct failure? Perhaps some one else will endeavor to answer the question, for as regards myself, my fears as to its merits were published 16 years ago. All that I can add to what was then said is that its future chance of success must depend on counteracting the obstacles referred to in this paper, obstacles which hitherto have constituted a barrier between every direct process and commercial success.

It has also been proposed to accelerate the direct process, and for that matter a great many other things, by the use of water gas, a form of combustible of which a good deal has been said of late. It is not to be denied that hydrogen gas, forming, as it does, half the volume of water gas, the other half being carbon already partially burnt, may, as a combustible, have an assured value in certain special cases. The hydrogen element affords above four times as much heat as the same weight of carbon, but unfortunately, and unavoidably, it requires more than four times as much carbon to produce it. We might, therefore, as reasonably expect a hydraulic wheel to pump back all the water which had served to move it as to hope to be able economically to burn any combustible twice over; for that is the impossible problem the water gas makers ask us to accept as possible. It is almost superfluous to say that the same line of argument is more than equally applicable to a proposal to use water gas in the blast furnace, which was also mooted some ten years ago. Its utter unfitness for this office is apparent when we consider that any steam formed by the combustion of hydrogen, and any carbonic acid generated by burning carbonic oxide at the tuyeres, will be returned to their original condition of water gas the next instant after their formation. In other words, heat generated by their being burnt will be entirely absorbed by the return of the constituents to the form in which they existed in the water gas previous to its combustion.*

In face of the admitted advantages in quality and cost of conversion of ingot over puddled iron, the fact that 2,250,000 tons of ordinary malleable iron were made in 1889 in Great Britain may seem, and no doubt is, difficult of complete explanation. There are several circumstances which conduce to this continued vitality, but into these there is not time here to enter. Possibly the puddling furnace may be employed for many years to come, but everything seems to point to a gradually decreasing demand for its produce. Should the day ever arrive when the labors of Bessemer or Martin's adaptation of the Siemens furnace for decarburizing pig iron entirely supersede the process of puddling, it must not be forgotten that the world owes to Cort an invention which, of itself, had revolutionized the art of locomotion, by sea as well as by land.

Mention has been made on a previous page of the hurtful effects of phosphorus in pig iron for steel making purposes. Unfortunately for Great Britain, its more extensive beds of ore were deposited at a geological period when the prevalence of animal life served to concentrate, in particular localities, the element so much objected to by iron manufacturers. This source of contamination, as it was deemed, appears to have been in active operation during the carboniferous age, and still more so while the rocks of the lias and oolite were in course of formation. Thus it is that the ores known under the general appellation of clay ironstone give an iron containing from .05 to 2.5 per cent. of phosphorus, derived from phosphates, chiefly of lime, a common constituent in animal bodies. More than 20 years ago it was pointed out how beneficial it would be if this phosphorus could be eliminated from the iron and laid on our land. We have lived to see this accomplished by the basic process, and, having regard to the growing demand for steel, it is difficult to overrate the importance of extending the area we have to look to for the raw material. Mr. Gilchrist informs me that the quantity of pig iron treated in the Bessemer converter and open hearth furnace during the year 1889 was close on 500,000 tons in the United Kingdom and 1,174,000 tons in other parts of the world.

The effects of the presence of foreign substances on the properties of malleable iron and steel are now universally recognized. This observation is more particularly directed to the injurious consequences which often result from the silicon, sulphur and phosphorus which remain after the conversion of the pig iron into these two forms of the metal. On the other hand, the service rendered by carbon, in conferring increased strength and elasticity on iron, cannot be exaggerated. This fact has naturally led to the inquiry whether other elementary bodies may not assist either in carrying off hurtful matter or in increasing the valuable properties just referred to.

The Discussion

on Sir Lowthian Bell's paper was opened by George W. Maynard who described a direct process plant now in operation in Pittsburgh, which is a commercial success. Mr. Maynard said:

I will take as the text for my remarks Sir Lowthian's final words on direct processes:

> If there is a spark of vitality in this obsolete plan, what have our ironmasters been about that they have not blown it into life? We have had, and have now, men among them who have distinguished themselves by the manner in which they have taken hold of every sound idea, scientifically propounded or otherwise, and ensured its success, often beyond the most sanguine expectations of the most sanguine inventor. It may well be asked how it is that this direct process has, up to this time, ended in direct failure? Perhaps some one else will endeavor to answer the question, for as regards myself, my fears as to its merits were published 16 years ago. All that I can add to what was then said, is that its future chance of success must depend on counteracting the obstacles referred to in this paper, obstacles which hitherto have constituted a barrier between every direct process and commercial success.

My answer to the statement that these processes have "ended in direct failure," is that to-day in the city of Pittsburgh a direct process is being carried on at the works of the Carbon Iron Company which is a commercial success. I have watched the development of this process off and on for the past 12 months, and have noted with surprise the success which has been achieved.

The following notes I am largely indebted to Mr. H. W. Lash, the able general superintendent of the works; Mr. Matthew Graff, the president director, and Mr. Alfred E. Hunt, of the Pittsburgh Testing Works, who has done much in

* *Traité de Métallurgie*, tome ii, p. 244.

* It is a remarkable fact that the document recommending this application of water gas was accompanied by a statement of an actual trial made at a Belgian ironworks, every line of which proved, in unmistakable terms, its complete failure.

the investigation of this process. Attention is called to a description of the Carbon Iron Company's process, in a paper written by Alfred E. Hunt, upon "Recent Improvements in Open Hearth Steel," page 708, volume XVI, "Transactions American Institute Mining Engineers," and also to a note upon a "Modification of the Reducing Process" used by the Carbon Iron Company, by the same writer, page 678, volume XVII, same transactions. In these two papers the process is accurately described in detail, and figures and data given as to stock used, quantity and quality of output. Mr. Hunt, in his first paper, says:

"The chief difficulty with all such processes has been not to reduce the iron and to make wrought iron from the ore direct, but to do this without heavy loss. The Carbon Iron Company uses as a reducing agent (which also protects the reduced iron from re-oxidation), a peculiar graphite from Cranston, near Providence, R. I. It resembles both graphite and anthracite coal, and has about the following composition:

	Per cent.
Graphitic carbon	78.00
Volatile matter	2.60
Silica	15.06
Phosphorus	0.045

"The principle of the process is that the peculiar graphite used as a reducing agent does not burn out rapidly, but adheres to the iron in considerable quantities in the sponge protecting it and allowing the balls to become compact and solid, so that when they are taken from the furnace they do not re-oxidize very rapidly, but can be squeezed and hammered or rolled without a comparatively severe loss. The oxidation in carrying the sponge balls from the reducing furnace to the open hearth, although the distance be considerable, is almost nothing. In fact, the sponge balls can be taken out of the furnace and allowed to cool off completely in the air with but very trifling oxidation—less than that upon an ordinary compact bar of iron of the same weight, and heated under the same conditions."

The process, as originally practiced with the Rhode Island graphitic carbon, was under the patents of Dr. Eames. The present process, however, is modified in almost every essential principle from the claims in the Eames patents.

1. The novelty of the process as now used consists in intimately mixing the finely ground iron ore with pulverized carbonaceous material, wet with a wash of lime or some similar inert material, in order to retard the too rapid combustion of the carbon, and thus give time for the dissociation of the iron and oxygen to take place at the temperature necessary for the reduction upon the "protected" carbon or graphite lined hearth, of an ordinary reverbratory furnace.

2. Each of the 16 reducing furnaces when in constant use has a hearth lined for about 10 inches deep with either graphite or coke washed with lime. These hearths are 19 feet long by 5 feet wide. The hight of the side walls from the hearth to the skewback of the roof is 22 inches, and the roof has a spring of only 3 inches. The furnace is heated by natural gas, which is admitted at each end, the stack being in the center of the roof. These furnaces are very durable, and require very little expenditure in repairs. The average life of the furnaces thus far has been at least a year before new side walls and roof are required.

3- Each furnace charge consists of 2240 pounds of finely pulverized ore, intimately mixed and ground well together, with 600 pounds of Connellsville coke, which has been crushed to very small particles, and wet with a wash of milk of lime to "retard" its too rapid combustion.

4. It is very important that the coke, or other carbonaceous material should be very intimately mixed with the particles of iron ore. Experience shows that it is only when the ore is fine, and in actual contact, particle to particle, with the solid carbon, that the best results in reduction are secured. Again, the intimate mixture of the ore and solid carbon helps to protect the carbon particles from too rapid combustion, and becomes itself an "inert retarding agent" for the carbon, in the same way that milk of lime acts.

5. Gas carbon, coke residuum from oil tanks, and in fact, limal oil itself, has been satisfactorily used as a carbonaceous reducing agent, the oil being mixed with the ore in such a way that when heated up in the reducing furnace, its residual coke, after the volatile matter has been distilled off and burned, is very intimately mixed with the particles of ore, which protect it from further combustion until it has performed its function of reduction of the iron. These forms of carbonaceous matter are used with very pure grades of ore, and where stock of very low percentage of phosphorus is desired.

6. Several patents upon the way of "retarding" the carbonaceous material, and the method of mixing the carbon and the ore, and of various carbonaceous materials used as reducing agents under varying conditions, and for methods of lining the hearth of the reducing furnace, have already been issued.

7. The iron oresused during the past year have been:

Minnesota Y ore, 62 to 65 per cent. iron, phosphorus. 0.06 hard red ore.
Lake Superior, Section 16, 65 per cent., phosphorus. 0.02 hard red ore.
Republic magnetite and specular 65 per cent., phosphorus. 0.06 hard black ore.
Hard Lake Angeline ore, 65 per cent. iron, phosphorus. 0.02 hard red ore.
Champion magnetite, 64 per cent., phosphorus. 0.05 hard black ore.

8. The time from out to out of a heat is a little over three hours, and three heats are made per shift, and each shift works between 10 and 11 hours, so that six heats are drawn from each furnace per 24 hours. The iron sponge is formed on top of the charge in about one and a half hours' action of the reducing flame, the remainder of the time being taken in balling up the heat, as in the ordinary puddling operation.

9. There are two men employed at each furnace—one furnaceman and one helper. It is the duty of the furnaceman to keep the bottom in good repair, regulate the heat, assist in charging and balling up the heat, and have general charge of the operations of his furnace. The helper assists the furnaceman in preparing the bottom, charging and balling the heat, and attends to the doors, carries the balls to the squeezer, and attends to the tools.

10. Each charge of 2240 pounds of 65 per cent. iron ore yields about 1440 pounds of squeezed sponge balls, of about 6 inches diameter, and, say, 15 or 16 inches long, weighing from 135 to 150 pounds each; ordinarily ten balls are taken from each heat. Of course the regularity of this depends upon the way the furnaceman balls up his heat. The regularity of yield from all the furnaces in the output is very remarkable, as compared to similar figures of the output of a puddle mill, and is largely due to the more accurate weight of ore than of pig iron charged, and to the fact that it is not as easy for the furnacemen to "steal stock" to increase their tonnage as in puddling.

11. The blooms contain, after having been squeezed, about 97 per cent. metallic iron, and rolled melting bars about 99 per cent. iron. The impurities in the carefully obtained average drillings of blooms and melting bar from the various ores are as follows, as determined by many analyses by the Pittsburgh Testing Laboraratory Chemists for the Carbon Iron Company:

	Y Minnesota.	Hard Angeline.	Lake Superior, section 16.	Champion magnetite.	Republic magnetite.	Old bed Port Henry.	This from mixture of one-half Lake Superior, section 16, with either Champion or Republic magnetite ores the other half.
Per cent. phosphorus in blooms	0.040	0.015	0.015	0.03	0.035	0.35	0.020
Per cent. sulphur in blooms	0.040	0.03	0.019	0.03	0.03	0.026	0.025
Per cent. phosphorus in melting bars	0.015	0.006	0.007	0.020	0.020	0.25	0.010
Per cent. sulphur in melting bars	0.040	0.02	0.010	0.035	0.020	0.016	0.015
Per cent. phosphorus in ore	0.063	0.02	0.025	0.045	0.06	.....	0.035
Per cent. sulphur in ore	0.035	0.03	0.035	0.040	0.045	.....	0.035
Per cent. metallic iron in ore	62.16	65.00	65.00	64.50	65.50	67.50	65.00

The column at the right hand, of the mixture of one-half Lake Superior, section 16 ore, with either Champion or Republic magnetite ore as the other one-half, is the ordinary mixture that has been used for the last six months, and the analyses of the blooms and melting bars is the average of the analyses of the material produced during the last six months, except in special cases noted elsewhere.

12. The process eliminates from the blooms, with low phosphorus Bessemer, ores at least one-half of the phosphorus in the contained ore, and with high phosphorus ores, fully two-thirds of the phosphorus is eliminated from the blooms, and further rolling of the blooms into melting bar purifies fully one-half of the phosphorus remaining in the blooms. Thus conclusively proving that the phosphorus still remains as a phosphate in the slag. In fact, the condition of the phosphorus in the blooms is still further proved by the fact that a considerable further elimination of the phosphorus may be secured from the resulting steam ingots by tapping off a considerable portion of the open hearth slag immediately after the melting af the blooms. The analysis of the open hearth slag shows it to contain a considerably larger percentage of phosphorus directly after the blooms have been melted in the bath than later, or when metal has become hot enough to tap. An examination as to the temperature of the furnace during the reducing and after balling operations will show you that at no time is the heat high enough to melt the reduced iron, and there is no doubt that the phosphoric acid in the gangue of the ore is not reduced to phosphide during the process.

The mode of charging either the direct sponge balls or the squeezed blooms with their initial heat into an open hearth bath permits of a much more rapid melt, with all its attendant advantages of improved quality of product, saving of time in melting and in labor connected with charging.

13. The present product of the direct reduction works of the Carbon Iron Company is about one-half sold and one-half used as blooms to be remelted in their own open hearth furnaces. Of the amount

sold, about one-third, or 17 per cent. of the entire output, is in the form of melting bar to be used in the manufacture of crucible steel, the larger portion of the remaining two-thirds in the form of blooms for melting in O. H. furnaces.

I am informed that the present output of the 16 reducing furnaces is fully up to 1440 pounds of squeezed blooms per heat, and with six heats per 24 hours, 8640 pounds per day, and for the 16 furnaces, 138,240 pounds, or 61 tons per day.

14. The fuel used is natural gas, and it unfortunately happens that the amount delivered to the reducing furnaces has not yet been metered; this will, however, soon be done when this important question will be determined. It is assumed that about 13,250 cubic feet of natural gas is used to the ton of squeezed blooms, in other words, the same amount used in puddling gross ton of pig iron.

15. The loss of metallic iron as claimed by the Carbon Company is 6¾ per cent. from the metallic iron in the ore to the metallic iron in the squeezed blooms. Mr. Hunt furnishes the following data as sustaining this claim: Two thousand two hundred and forty pounds of 65 per cent. iron ore containing 1456 pounds of metallic iron will yield 1400 pounds of squeezed blooms, containing 97 per cent. metallic iron. This weight of blooms will contain 1358 pounds of metallic iron, showing a loss of only 98 pounds of iron, or, 6 and $\frac{73}{100}$ per cent. of the total iron in the 2240 pounds of ore used. The fact that these squeezed blooms contain 97 per cent. metallic iron, is not only determined by the average of many analyses, but also from their yield in steel ingots when added to an open hearth steel charge. An average melt of open hearth steel of pig iron and scrap will give a loss of about 7 per cent. reckoning the weight of pig metal to be all iron; similarly reckoning charges of 40 per cent. pig metal with 60 per cent. carbon blooms, gives an average loss of between 12 and 13 per cent.—about what would be expected with squeezed blooms of 97 per cent. metallic iron. Similar charges of 40 per cent. pig iron, with 60 per cent. of squeezed puddled blooms, give a loss of between 10 and 11 per cent. and we have found similar average check analyses of the puddled blooms to show about 99 per cent. metallic iron.

The quality of the steel containing considerable quantities of the Carbon Iron Company direct made iron, as has been previously stated in the papers on the subject in the transactions, A. I. M. E. is very superior, and is especially noted for its durability. The following tables show results obtained by them in regular practice:

Quality.	Carbon.	Phosphorus.	Manganese.	Ultimate strength, pounds per square inch.	Elongation, per cent. in 8 inches	Reduction, per cent.	Test specimens will bend.
Dead soft steel.....	0.10	0.060	0.40	49,800	36.00	75.00	on themselves 180°
Dead soft steel	0.11	0.058	0.42	50,600	35.00	72.00	on themselves 180°
Flange steel.....	0.13	0.068	0.45	55,200	30.00	68.00	on themselves 180°
Flange steel.....	0.14	0.065	0.46	56,390	31.00	70.00	on themselves 180°
Soft bridge steel....	0.14	0.075	0.52	58,100	31.00	65.00	on themselves 180°
Soft bridge steel....	0.15	0.082	0.56	60,200	29.50	62.00	on themselves 180°
Medium bridge steel	0.16	0.080	0.53	64,100	29.00	59.50	on themselves 180°
Medium bridge steel	0.18	0.078	0.55	66,900	28.00	58.00	on themselves 180°
High bridge steel....	0.22	0.082	0.58	72,800	25.00	50.00	around pin
High bridge steel....	0.24	0.076	0.60	78,600	22.50	45.60	thickness of test piece.

I am not aware that the claim has ever been made by the Carbon Iron Company, or its representatives, that this process is to come in as a competitor of the blast furnace, as intimated by Sir Lowthian Bell. The claim is the production of a uniform and much cheaper material, for the open hearth and crucible steel processes, than can be obtained in any other way. The high character of open steel made by the Carbon Company, and the constantly increasing demand for the squeezed blooms and bars rolled directly from these blooms by other steel manufacturers, has practically settled the question of quality.

PROF. H. M. HOWE, OF BOSTON,

continued the discussion. He thinks the direct process has great possibilities, and he states his reasons. He points out the advantages to be derived from the direct process and considers the loss of iron in direct processes of the past. He said:

I think that very few people of good judgment can refrain from agreeing with Sir Lowthian Bell's conclusions, that the blast furnace is more likely to be able to do without the direct process than the direct process is likely to be able to do without the blast furnace; but I think it might be considered somewhat rash to conclude that because the blast furnace is likely to hold the upper hand, that the direct process may not be very applicable and may not be very economical under certain conditions.

The direct process is a much more difficult and complicated process than is the blast furnace process. Being complicated, it is somewhat more difficult. It requires greater skill and it requires special conditions. Now, it seems to me a little like the case of an absolute monarchy and a limited monarchy. A limited monarchy is a much more difficult and complicated system of government to carry out, but at the same time we think that it is a much better system. The compound engine is a much more complicated thing than the plain slide valve engine, and yet, under certain conditions, it is the better of the two. The direct process seems to me to have great possibilities. In a blast furnace we have not only to do the work of the direct process, but a great deal of other work also. The work of producing iron, we may say, consists, in the first place, of the chemical work of oxidizing the iron oxide; in the second place, in the heating work in raising the iron and the other materials associated with it by nature to a very high temperature. In the case of the direct process (and I do not speak of any one direct process in particular, but simply of the direct process in general) practically it is not necessary in the nature of things that the temperature should ever be above red heat. In the case of the blast furnace, it is hard to see how the temperature can well be less than the melting point of a very infusible silicate of lime—chiefly of lime. There I think that we have a great possibility that the direct process will need not only the getting of a low temperature in the blast furnace, but that we must have a very high temperature. The direct process calls for certain conditions, and I do not see how it can be applicable to ores of iron unless those ores are magnetic or otherwise centered. It seems to me it must be applied to very rich ores, as I cannot see how otherwise it would be possible.

The other and special condition which makes possible the success of the direct process is the existence of a fuel which can be applied to the direct process, and which cannot be applied to the blast furnace, and which is much cheaper than any local available fuel which is applicable to the blast furnace. That at once gives in the direct process an enormous advantage; and, therefore, many who wonder at the success of the Carbon Iron Company's process in this city do not realize that it is in a large measure due to the fact that for that process natural gas can be applied, while for the blast furnace natural gas cannot be applied. Here in this city the Carbon Company's process possesses an enormous advantage, which it might not have elsewhere. How much weight can be attached to that point further investigation must determine. As to the loss of iron, is it quite just to say that because the loss of iron has been enormous in some of the direct processes carried out in the past, without the metallurgical knowledge or skill of today, it always must remain so? Professor Maynard has got the loss at a point which I think will strike every one as extremely low. I have had access to most of the data from which Professor Maynard speaks, and I do not think it is quite beyond the mark to put it as low as that from his data, as I find the loss to be about 17 per cent., which is equivalent to saying that 100 parts of ore will yield 83 parts of ingots by the direct open hearth process.

G. J. SNELUS, OF WORKINGTON, ENGLAND,

described some experiments he made with the direct process over 20 years ago. He thought that while the blast furnace is not to be discarded there is a direction in which the direct process can be utilized. He said:

I have had some experience with the direct process very many years ago, for so it happened that the first patent with which I was associated was taken out by the late Mr. Menelaus, of Dowlais, for a direct process of making iron. I was also associated with Sir Wm. Siemens in his direct process for making iron. I therefore tnink that I may venture to say a few words in connection with this paper by Sir Lowthian Bell. Of course I think we shall all admit that the blast furnace is not going to be ousted entirely by the direct process. I think we may state that as a fact, and in that respect I certainly agree with Sir Lowthian Bell. Where we require pig iron for foundry work, where we require it for anything with which it is used as pig iron, there certainly the blast furnace must always hold its own.

My first experiments on this subject were made some 23 years ago, and, curiously enough, in the presence of a Pittsburgh man, Thomas Blair. He happened to be at Dowlais at the time, and attempted to introduce what was then called the Oberhausen process. That attracted my attention, and I set to work to make a number of experiments upon the reduction of the iron ores with which I was acquainted. I did it in this way: I reduced the iron ore to a fine state of division, and then took the exact time that was required under the most favorable circumstances to get rid of the oxygen and to get metallic iron, and I found that it was possible, under the most favorable circumstances, to reduce the oxide of iron, to get rid of the oxide and to get metallic iron from cold iron ore in two minutes. I think that is a very important factor to bear in mind; that the hold which oxygen has upon iron in its combination is not of a powerful character, but that under proper conditions the hold will be lessened and the metallic iron set free in a very short space of time. That is one factor for consideration.

The exact arrangement which I patented for obtaining iron by the direct process was the application of the German furnace termed the Guesvenhoeffer. This was simply a tall vertical chamber of brickwork in which there was a series of horizontal fire bearings of V-shaped sections. The furnace was used at Messrs. Vivian's copper smelting works, and I saw it there used for burning the sulphur out of the pyrites. My friend Mr. Thielen, the president of the German Association here, was then the president of those works. I went to see the furnace, to see how far it was applicable to a direct process of making iron. I am proud to say that that was my first interview with Mr. Thielen, and I have in my pocket book now a sketch which he very kindly made for me of this furnace. I came back convinced that there was an apparatus which could be utilized to produce steel by the direct process. In the Guesvenhoeffer furnace, when used for calcining pyrites, the air is admitted to burn the sulphur. My idea was to reverse the operation, heat the furnace and instead of introducing air to introduce gas, carbonic oxide or hydrogen. I mentioned the matter to Mr. Menelaus, and he consulted the late Dr. Percy as to its practicability. The verdict of Dr. Percy was that it was entirely right, theoretically, but that it remained to be proved by practical experiment how far it would answer.

But now it appears that you are going to find it necessary to reduce a large quantity of your magnetic ores, which are so abundant in this county, to a fine state of division, for the purpose of improving them by the magnetic separators; and we were told at New York that separators were now to be put up to treat, as I understood, 1000 tons of ore per day, at one concern. If this is so it is quite evident that there is going to be a vast quantity of ore of this minutely divided condition which is available, and will be available, and will be better used by some such process of direct reduction, where you can get the reducing agent into intimate contact with the finely divided material. What I insist upon is that if you apply the direct process you should deal with the materials in as minutely comminuted divisions as you can. The ore should be as fine as possible, and the reducing agent should be also in a fine state of division, or it should be gas. I think, therefore, that while I agree with Sir Lowthian Bell that we are not going to oust the blast furnace, yet that there is a direction in which the direct process may be utilized, and in which it will prove even more economical than the combined process of the blast furnace and the Bessemer converter or the Siemens open hearth furnace.

SIR LOWTHIAN BELL,

in conclusion, described the direct process of Mr. Blair and pointed out the reasons for its failure. He critically examined the points made by Mr. Maynard and by Mr. Snelus. He said:

Well, sir, I do not know that I need detain the meeting very long to make a reply. I will just add that so far as the operation referred to by Mr. Snelus is concerned I have myself had some correspondence with Mr. Blair. In the year 1874 I visited Pittsburgh, and was taken by Mr. Blair and most kindly received by himself and his partner—Mr. Morrison, I think—to their works in the immediate vicinity of this city. The figures illustrating their process were submitted to me in the most open manner. I endeavored to the best of my ability to show to Mr. Blair by his own figures that nothing but failure would ultimately attend the process. I am sorry to disagree in that, but I need not remind the inhabitants of Pittsburgh what the fate of the works was which undertook to make iron by the direct process of Mr. Blair. Now, leaving altogether the question of economy out of consideration—which, of course, one cannot do—but looking at it as purely a matter of chemical reaction, no process that I know of could be more perfect in its character than that adopted by Mr. Blair. It was the Chenot process, with a little refinement and so arranged that a saving of fuel, at all events in heating the ore, was attained. All oxidation from the atmosphere, so far as was possible, was avoided by the sponge, as it was drawn downward and received into air-tight cases until it was cooled, and the sponge was then mixed with coal tar, and under very powerful hydraulic pressure was pressed into bricks or cylinders, and these were then transferred to an open hearth furnace, in which there was a certain quantity of pig iron in order to produce steel. It was there that I pointed out to Mr. Blair at the time that the great loss occurred.

My friend, Mr. Maynard, has not told us anything about the loss that is incurred in treating the blooms obtained by this new development of the direct process. That is a most important matter. Now, with regard to the total fuel required. Pray remember that this ground coke which is used in the reducing furnace amounts to 960 pounds to the gross ton of iron. In other words, they are using in this furnace more than one-half the coke which is used in the blast furnaces. That is, instead of using about 1808 pounds, they are using, as we learned the other day at the Edgar Thomson Works, 960 pounds; that is, instead of saving about 400 weight of coal, as is done in the Bessemer furnace, they use nearly 1 ton of coal for the reduction of the ore. That is, you have to use 960 pounds of coke which has to deoxydize the air, and then you have something like a ton of coal to use in order to heat the blooms before you are ready to heat the ore for its reduction. Now, independently of all that, I am surprised that gentlemen should talk in the very easy and airy way in which they do of grinding the quantity of ore that you have to deal with in order to bring this industry into anything like an industry of importance. We are told that we must grind the ore into the finest possible divisions, and they speak of it as if that was a thing of easy achievement. Conceive that you are to start and grind the whole of the ore in the Lake Superior region, which I think is something like 17,000,000 tons per year, into a fine dust, and you have an idea of what you are proposing. I admit that there may be some cases in which very fine ores might possibly, to a very limited extent, be so treated, but to expect to raise that to a great industry, and to compare that with what has been done in the blast furnace, is, in my opinion, one of the most Utopian ideas that ever entered the mind of man.

Mr. Snelus in like manner seemed to underrate the obstacles in the way of obtaining that result. At all events the gentleman whom he mentioned certainly did not in their experience attain it, and certainly they were characterized by a patience which you rarely find in a manufacturer. They continued the work until it was impossible to continue the operation any longer, and it disappeared like many other of the direct processes before it. I do not know that I can add anything more to what has been already said. I cannot say that the observations of Mr. Snelus or Mr. Maynard have made a very profound impression upon my mind.

The next paper considered was on

The Protection of Iron and Steel Ships Against Foundering from Injury to their Shells, Including the Use of Armor,

by Sir Nathaniel Barnaby, late chief constructor of the British Navy. He said that against the perils arising from perforation of the hull we are worse off now in the days of iron and steel than we were when ships were built of wood. The material now used submits easily to perforation. When a wooden ship is struck in collision the blow is gradually absorbed and there is but little permanent displacement and but little admission of water. The paper describes a proposed ship 1000 feet long and 300 feet wide to be propelled by engines of 60,000 horse-power. Then are described the methods to prevent the rolling of a ship. The questions of watertight compartments, iron and steel plates and the disposition and material of armor are considered at length. In part the paper was as follows:

Long steamships cannot be built of wood. Steamships built of wood cannot be secured against premature decay; they cannot be built quickly without the certainty of rapid decay; the risk of fire is always serious in them, and except in very small vessels high speeds are impossible. The ships in use and building for commercial purposes on the western side of the Atlantic are still constructed generally of wood. The large sailing navy of the United States may be said to consist almost exclusively of wooden ships. America possesses nearly one-sixth of all the wooden sailing ships of 100 tons net and upward in the world, and she will probably find it to her advantage for many years to come to continue to build such ships of wood. Of iron and steel sailing ships Great Britain owns considerably more than three-fourths of all that exist. When we come to the steam mercantile marine we find that the United States has as many of her mercantile steamships of 100 tons gross and upward built of iron and steel as of wood. There can be no doubt that both here and in Canada you must follow the example of Great Britain, and build steamships almost exclusively of iron or steel.

It is the one prominent defect in iron or steel ships that I propose to consider, and that only—viz., the readiness with which they submit to perforation in collisions.

Security against risks of fatal disaster, on this account, depends very little, if at all, upon the thickness of the bottom plating or the closeness of the ribs. The advantage of a steel plating of 1 inch in thickness over another of ½ inch would be very doubtful; and closeness of frame-spacing is not much more valuable.

When open-hearth steel was first employed for the outer bottoms of ships, with a reduction of some 25 per cent. in thickness as compared with iron, it was supposed that the structure would be found to be lacking in rigidity.

Security in an iron or steel ship against fatal injury, arising from the perforation of the shell under water, depends upon two things only—SIZE and SUBDIVISION.

Pumps may be dismissed at once as being practically useless in cases of collision in iron and steel ships. No pumps will deal with a continuous inflow of water of even less than ½ square foot in area coming through a hole well under water. Apart from the perfection of subdivision, size is in itself an element of safety. A ship of small or moderate size is sometimes completely severed at the point of striking by the blow of a larger ship.

I am supposed by some persons to object unduly to large ships. But I confine my objections as to size of ships of war in a powerful navy. I believe that a large naval power, having very widely spread interests and subject to modern modes of attack, would suffer more in a war from fewness of ships than from comparative smallness of size of ships and of crews. I have never thought that size is a disadvantage in merchant ships, supposing they can be worked financially. On the contrary, the advantages arising from size in passenger ships seem to me to be so great that I do not see where we shall stop. If it were necessary to increase the draft of water as we increase the length and breadth that would impose a fatal bar to any considerable advance upon present dimensions. But there is no such necessity. By the use of several engines working side by side and suitable propellers the draft of water of 26 feet need never be exceeded.

A SHIP 1000 FEET LONG, 300 FEET WIDE.

I was consulted some years ago by a business man, well known on both sides of the Atlantic, as to the possibility of building a steel ship which would not roll, or pitch, or heave in the sea, and in which, therefore, the bulk of passengers would be in less desperate hurry to get ashore. He thought 15 knots an hour sufficient speed. It appeared to me to be perfectly practicable with a draft of water of 26 feet. I thought the minimum length and breadth would be 1000 feet long and 300 feet broad. I estimated that with engines of 60,000 horse-power an ocean speed of 15 knots could be obtained. Two sets of apparent difficulties had to be overcome—viz., those connected with the building of the ship afloat, and those relating to receiving and discharging cargo. The ship would be a steel island, incapable of entering any docks. The building difficulties soon disappeared. They had no real existence. To meet the other difficulties, I proposed to form shallow, still water harbors or docks within the ship, entered by gates in the sides, and to carry, always afloat there, the loaded barges and tugs; turning the barges out and taking in fresh ones already loaded at the ports of discharge and shipment. Such a ship would require to be fortified and garrisoned like a town. She could be made absolutely secure against fatal injury arising from perforation. The subdivisions required for this purpose might be made to serve effectually against the spread of any local fire. I do firmly believe that we shall get the mastery over the seas, and shall live far more happily in a marine residence capable of steaming 15 knots an hour than we can ever live in sea side towns. The question whether we shall effect our conquest by mere size, or by mechanical devices, in ships of more modern proportions, depends upon the success of certain efforts which are now in progress in another direction.

ATTEMPTS TO PREVENT ROLLING.

In these efforts there have been three stages:

First, there were the observations by the British naval constructors at the Admiralty that when a gun or water or other loose weight is moved about violently by the rolling of the ship these movements of the loose weight tend to bring the ship to rest. The phenomenon is fully discussed in the *Encyclopædia Britannica* article "Shipbuilding." The physical conditions have been briefly stated by one of the Admiralty officers as follows: Explaining the effect in a model of a moving weight representing 100 tons bringing nearly to rest almost immediately what represented a vessel of 10,000 tons, he says the same effect must always occur in a rolling ship if we have a loose weight of any kind, whether the weight be water or a gun. If this reduction in rolling did not take place "we should have something to explain which would be quite inexplicable. For suppose we have two ships alike in all respects as regards size, shape, weight, time of oscillation, &c., and situated on precisely the same seas, but one having all her weights properly secured and the other with a weight capable of transversing the deck every time the ship rolls. If the two vessels were to roll to exactly the same extent we should have the sea not only rolling the ship with the loose weight to the same extent as the ship with all her weights fixed, but the sea would, in addition, be doing all the work involved in the traversing of the heavy weight across the deck, which is quite impossible under the circumstances of perfect similarity supposed. The sea can only do the same work on both. In the one case the work consists entirely in rolling the vessel; in the other it consists partly in rolling the ship and partly in dashing the weight about. The rolling in the latter must, therefore, inevitably be less than in the former case." This principle is now applied by constructing water chambers above the shot proof decks in the larger ships in H. M. Navy. But by this system a certain amount of rolling is required in order to start and work the rolling quencher, and something further is needed in passenger ships. It is desirable to have a more delicate appreciation of the first tendency to rolling and an instant application of the quenching apparatus.

The next step was taken by Beauchamp Tower, an able English mechanical engineer. He contrived a mechanical watchman dependent upon a long pendulum indication. This watchman has sufficient power to control a small platform carrying a gun or other instrument. In a heavily rolling ship the watchman keeps this platform and its load level and at rest. See "Transactions" of the Institution of Naval Architects, 1889.

The third step has been taken by Mr. Thornycroft, of torpedo boat fame. He also makes a mechanical watchman, differing from Mr. Tower's, and dependent upon two pendulums, one long and one short. This watchman is capable of controlling a large movable weight. Mr. Thornycroft describes his plan as follows: The controlling apparatus depends first on a pendulum, or its equivalent, having a short period compared with the natural period of oscillation of the vessel to be steadied, or of the waves on which the vessel floats.

A second pendulum, or its equivalent, having a long period, compared as above, and a large moment of inertia is adapted to join in control with the short pendulum, and more or less balance its tendency to reduce stability when the vessel is inclined. The steadying apparatus comprises a heavy movable weight fixed to a shaft in such a manner that it places itself automatically, when free, in the fore and aft position. It is controlled by a hydraulic motor capable of turning it to one or other side of the center line of the ship, as may be necessary to balance a turning moment exerted on the vessel by waves, or to prevent or lessen the rolling. The distributing valve of the motor is controlled by the pendulum apparatus above described. It is proposed to employ a movable weight of about 12 tons for a vessel of 250 to 300 tons displacement. Its range of movement would be such as would transfer the center of gravity of the weight through a transverse distance of 6 feet. If this third step is made successfully, and Mr. Thornycroft's plan is applied to passenger ships, there will be no necessity for pressing forward large ships in advance of their due time.

BULKHEADS.

When an iron or steel ship is sunk by collision, it is sometimes mistakenly said that the ship had a number of bulkheads or divisions, and that since these failed to keep her afloat, it matters little whether bulkheads are fitted or not. It often happens that a ship is sunk when only a comparatively small hole is made in a single compartment. The badly arranged bulkheads do not even delay the sinking. The water spreads itself differently owing to the presence of the bulkheads, but that is all. Instead of leveling itself from end to end throughout the ship, and gradually rising all fore and aft, the water first fills one compartment, then finding the top of the partition separating it from the adjacent compartment has been brought below the level of the outside water, it proceeds to fill that compartment, and so on

In the year 1866 this question was fully debated by an influential committee of naval architects, shipbuilders, shipowners, Lloyds' surveyors and sailors. The committee was the Council of the Institution of Naval Architects. That council decided that no iron passenger ship is well constructed unless her compartments be so proportioned that she would float safely were any one of them to fill with water or be placed in free communication with the sea. They recommended that all iron ships should be so divided that not only the one largest compartment, but any two adjacent compartments, might be given up to the sea without sinking the ship. The second is an advisory clause, the wisdom of which is not disputed. The first is condemnatory of badly constructed ships. No deliverance of any kind has been made during the 24 years which have elapsed questioning these important decisions. Yet they are absolutely ignored by everybody concerned, and all iron and steel sailing ships built since then, and the great bulk of steamships, have been built in disregard of the recommendations of that council; and in so far as they are used for carrying passengers or emigrants, all these ships have been, and are, in the judgment of that council, badly constructed. It is quite true that there are water tight bulkheads—one or more—in every such ship; but they exist for structural purposes only, and not to carry out the view of the council or to prevent the foundering of the ship when run into.

Sailing ships generally have but one bulkhead and that right forward. Some —a few—owners have added another "collision" bulkhead aft; while others again, with the desire to provide extra safety from foundering, have introduced one or two others in addition to these two "collision" bulkheads. But these are merely so much dead weight—adding, of course, to the strength of the ship—they would not appreciably alter the time of foundering if the ship were struck anywhere between the two end bulkheads. They do not go far enough to satisfy the necessary conditions. The highest number of bulkheads believed to be built in any existing sailing ship proper—that is, an "unconverted" vessel—is four, and these cannot be placed so as to materially alter the time in which a vessel would founder if struck in any compartment. It must be generally understood that records in registers and examination by surveyors referring to bulkheads in steamships give no security in respect of the fulfillment of this most important condition.

MATERIAL.

The question of material has been settled for you. The troubles we had with iron on our side are a matter of history. In 1874 we were giving for iron ship plates of about 7½ hundredweights each, delivered at Portsmouth Yard, over £20

per ton (with a scale of extras, from 3½ hundredweight upward, per ½ hundredweight). These plates were tested by resident inspectors at the iron works. This had been found to be necessary, as inspection at the ship side prior to acceptance had been found to cause vexatious delays and heavy rejections after such delays, so that there was often a paralysis of work with both ironmakers and shipbuilders. This being the condition of things in 1874, a Naval Committee was appointed to consider the causes of the rapid deterioration of boilers. This committee visited Portsmouth, and reported that it was necessary to secure a better quality of iron. They said that "the rapidity of deterioration of boiler plates and ship plates is greatly dependent upon the purity of the iron, which can only be obtained by increased expense of manufacture." They recommended the payment of higher prices than £20 per ton for 7½ hundredweight plates. It was then determined to meet the increased cost of bottom plates recommended by using for inferior purposes untested plates—*i. e.*, plates bought on the faith of the "brand" of the maker. Such "branded" plates were at that time employed for all purposes in ships built under the survey of Lloyds' committee. Here we had a curious experience which satisfied us that if we could once get material of definite manufacture, and precise and easily recognized qualities, wide competition would speedily equalize prices. We took ten prominent makers of iron plates, and secured delivery of "branded" plates to an identical specification. The plates were about 7½ hundredweight each. The plates were delivered at Chatham, and were then tested and examined by me, with the following results :

Prices of 7½ Hundredweight Untested Iron Ship Plates in 1874.

Cost per ton.	Quality of material.	Condition of surfaces of plates.
L. s. d.		
9 13 0	Strong, but harsh	Two-thirds unfit for use for shipbuilding.
9 4 0	Strong, but harsh	Two-thirds unfit for use for shipbuilding.
17 12 0	Strong, and fairly ductile.	Good.
18 2 0	Strong, and fairly ductile.	One-fourth unfit for use for shipbuilding.
9 13 0	Irregular in strength, fairly ductile.	All unfit for use for shipbuilding.
22 12 0	Good.	Good.
12 2 0	Strong, and fairly ductile.	One-sixth unfit for use for shipbuilding.
19 3 0	Weak, and not ductile.	Good.
9 15 0	Fairly strong; ductile.	One-sixth defective
12 13 0	Strong; ductile.	Good.

In all these cases the extras for breadths over 4 feet and lengths over 12 feet raised these prices still higher, or involved the cost of fitting and riveting small plates. Now, in 1890, you have a perfectly regular material, stronger and more ductile than any of this iron, with no trouble as to surface blistering and lamination. You can get Siemens plates of 20 hundredweight, almost without extras for any increased size, delivered at the ship's side at less than £8 per ton. It has, unfortunately, been as low as £6, 5/. This change from iron to steel was not made without a vast amount of anxiety on the part of responsible engineers who led the way. The result may not be altogether pleasant to the iron and steel makers. To the ship builder and engineer it calls for ungrudging acknowledgment of indebtedness to two eminent British subjects, Bessemer and Siemens, and for the grateful recognition of the enterprise and skill of French, German and British makers. We all owe Germany a lasting debt of gratitude for the birth and training of that true prince William Siemens.

ARMOR.

In modern ships of war the main use of armor in the formation of shot proof decks adjacent to the load water line, and of more or less complete belts of side armor combined with such decks, is to protect the machinery and magazines from shot and shell.

There has been a wide abandonment of side armor founded upon the recognition of several facts:

1. The increasing penetrating power of the gun. The 12-inch gun is now more than a match, at close quarters, for the best 18-inch steel plates. It requires the best 9-inch armor to keep out steel projectiles from the 6-inch gun at short range.

2. The great volume and accuracy of shell fire makes the original arrangement of broadside ports in an armored side inadmissible. The crowding of men in the rear of an open or unarmored port can no longer be accepted.

3. The propelling machinery and the magazines are of more consequence than the whole battery of guns, because the ship has become, by virtue of her ram and torpedoes, a powerful fighting machine apart from her guns.

4. The large use of side armor, by reason of its weight and cost, limits the number of ships obtainable with a given sum of money.

But while side armor has been largely suppressed and superseded for these reasons, it still possesses one great advantage. It prevents the entrance of water into the zone between wind and water through holes made by light projectiles not capable of perforating armor, but capable of damaging seriously an unarmored side. Those who have appreciated most keenly the value of side armor at the water line for preserving the floating power of the ship against light guns have sometimes failed to see that my apparent unreadiness to concur with them has arisen from real sympathy.

My contention has been that all armed fighting ships present equal claims to be kept afloat against the attack of the guns which they have to face. I consider that in all such ships the first duty of the designer is to enable the crew to inflict damage on the enemy. Arms and mobility, therefore, come first; endurance under gun fire next. There must be degrees, varying with the size of the ship, in the strength of the arms and in the amount of the mobility. But all the fighting men, except those in forlorn hopes, are equally entitled to a chance of existence under the artillery fire which they must receive and endure. I have been unable to understand the exclusive claim for protection by means of side armor in a particular class of ships in a large navy, such ships not being distinguished by exceptionally large crews, nor as being centers of operation for a fleet, nor as being required to attack fortresses.

And the question as to the use of belt armor in classes of ships not distinguished as above is perplexed by the following considerations:

First, and generally, whether, in strengthening the water zone by side armor against feeble projectiles, we do not expose it more to the very serious attack of larger ones than it would be if formed with an armored deck near the water.

Secondly, whether with a ship of given size and cost we are not sacrificing active offensive qualities for the sake of a passive defensive quality. Speed of ship, power of armament or stored up capital (expended in the ship) may be made to pay too dearly for a passive defense against the invasion of water at the water zone, seeing that the invasion of water beneath that zone becomes a more imminent and more serious peril to the State in proportion to the reduced speed and the increased cost. So we arrive at an alternative arrangement, a solid raft body at the water zone in place of side belt armor. It appears that such a raft body can be made which, when undamaged, weighs with its casings not more than one-third the weight of water, and which, when saturated, does not exceed the weight of an equal bulk of dry fir. Such a system of water line defense may prove suitable for all fighting ships, large and small, by reason of its lightness and small cost. As I understand the position, it is proposed to give a trial to this system in the navy of the United States. I think the time is coming, if it is not already come, when there will be a demand not only for the recognition of the equal claims of all fighting ships to be kept afloat against the attack of the guns which they will have to face, but also that their crews between decks should be equally protected against the overwhelming effects of the bursting of high explosives there.

For belt and battery armor it is still a matter for debate whether the process of manufacture first introduced, and since most successfully developed, by M. Schneider, or that subsequently devised and manufactured in Sheffield, is the better.

ARMOR TRIALS.

After this paper has left my hands, and before it will be read, there will probably be an interesting series of trials of armor on both plans in the United States; what I say may therefore be very brief. Both systems have been in open competition from the beginning, and gun trials have been made by all the maritime powers. The experience of the Sheffield compound armor plate makers as to their own manufacture and that of their rivals has been very great. The amount of steel faced armor which has been manufactured by them, or by their licensees, during the last 12 years, together with that which is in process of manufacture, equals 112,000 tons.

They urge several considerations in favor of steel faced armor. They say that steel armor cracks through under blows which are not sufficiently powerful to perforate the plate. They consider that the manufacture of steel armor is less uniform and certain because it is of very great importance to oil harden and anneal such armor, and these processes are not required for steel faced armor. They point out that this treatment can only be applied commercially to large and awkward plates with great risk, expense and difficulty, and that under these circumstances a good test plate offers no security as to the quality of the plates it represents. It is conceded that hard faced armor endures better under oblique blows. They say that a cubic foot of steel armor weighs 492 pounds, whereas a cubic foot of compound armor weighs only 480 pounds—a difference of 2½ per cent. in favor of the latter.

An experiment has recently been made in England to ascertain whether it can be confidently stated that oil hardening and annealing, or some equivalent finishing process, is necessary for steel plates. Messrs. Brown and Messrs. Cammell, the two great Sheffield firms, makers of compound armor, are satisfied as to this necessity. A 9 inch plate of steel was manufactured and cut into two plates each 4 feet square. One piece was left untreated and the other was oil hardened and annealed. They were fired at by the 6-inch gun with Firth steel projectiles weighing 100 pounds. The striking energy of the blow upon the untreated plate was 2389 foot tons, and the energy of the blow upon that which had been treated was 2378.5 foot tons. In the latter case the

projectile made an indent of 10.5 inches, so that light was just visible through the center of the bulge at the back of the plate. The projectile rebounded, broken into three pieces. The plate was cracked through, but was whole, and no material was splintered out at the front or back of the plate. In the case of the untreated plate the shot passed through, and the splintering of the steel round the hole in front of the plate spread over a space 15 inches across. The splintering round the hole at the back of the plate covered a space 33 inches across. The plate did not remain whole, but went into six separate pieces.

I am myself no lover of armor. As a member of a great and peaceful trading community, I dislike everything which, by differentiation, tends to lower the comparative fighting value of the armed mercantile ships. I dislike also that which reduces the available number, by increasing the individual cost, of ships of war. There is, I think, no such necessary and vital distinction between the man-of-war and the properly armed and protected state auxiliary of high speed as would justify the neglect of such auxiliaries for maritime warfare. One must admit that at present there are very great differences between them in fighting value, ship for ship, due partly to the very superior subdivision and partly to the use of armor of high quality in the regular ship of war. The man-of-war proper will probably never abandon the use of armor. We may rather expect that steel and steel faced armor of the highest quality, instead of being confined to a few ships, called battle ships, will be employed universally for the defense of the absolutely vital parts of every ship built expressly for war service.

Discussion.

Commander F. M. Barber, U. S. N., opened the discussion of the above paper. While he agreed with the author in some points, there were many most essential features which he criticized. He thought the large vessel practicable, but that it would be useless if it did not have speed. He also discussed the question of bulkheads and armor. In part he spoke as follows:

Sir Nathaniel's paper opens with the observation that the difficulty in stopping leaks in iron ships is far greater than it was in wooden ships. He is very right about that, and we have not got over the difficulty yet In old times, in wooden ships, we had two or three very simple methods of doing it. We had the old-fashioned shot-plug, which looked very much like a loaf of Martinique sugar, that you could drive into the shot-hole of any size, and it would close it up. We also had felt planking which we could nail on the side of the ship. We also had a method of flowing oatmeal and sawdust into a seam, which would fill it up. But none of these will work in a single skin iron ship.

THE LARGE SHIP.

Apart from that, the first essential portion of the paper is where he speaks of the large size of vessel which he would propose to build, or had proposed to build. That is to me a very curious and interesting discussion because it is all feasible; every bit of it feasible; only I think that if the Great Eastern with 24,000 tons displacement was no good, this vessel, with over 100,000 tons displacement, would be equally no good if she did not have speed.

BULKHEADS.

He refers to injuries to the bulkheads of vessels, and after some discussion he mentions the type of bulkheads which has been adopted by the Lloyds; but I think that he omitted to state the most essential feature which modern practice has brought about in connection with bulk heads. It is of no use to have a bulkhead unless it is high enough to go above the water line when the compartment is full, for you can easily understand that if the water can flow over one bulkhead it will then flow into the next one in succession, and finally sink the ship. In the next place, a water tight bulkhead is no good unless it really is water tight. The next essential feature in that connection (and one which Sir Nathaniel omits) is the fact that we find that all men-of-war now, and all of the largest merchant steamers, have twin screws, which enable you to get the bulkheads fore and aft right through the ship, and that creates a long subdivision which is of primary importance, and after that you only need to subdivide into smaller spaces.

ARMOR.

He speaks of the distribution of armor plate. I may say that the matter of the distribution of armor has largely been due to the development of artillery. In the old days of smooth bore guns, a 4-inch armor plate was enough to keep out projectiles; and it was put all over the side of the ship. When we got to rifled guns and greater projectile energy it was necessary to increase the thickness. They had to reduce the space, in naval construction, and allow only 20 to 25 per cent. of the displacement of a vessel for the armor. We must keep this then in mind. They had to thicken it up, and naturally they thickened it over the vital parts; and they maintained a heavy belt along the water line, fore and aft. But very soon it was found that they could hardly get it thick enough there, and then they introduced what they called the protected deck, below the water line, and now the armor line is mostly confined to the center of the ship.

He speaks of the water line of the armor being penetrable by the larger projectiles. I think he makes a mistake in that, because in our battle ships we have 18 inches of heavy armor, which is exactly what the English have on the larger battle ships which they are now building, and I should think that that would practically keep out any projectile. The chances at sea are very much improved for the armor, but not very much diminished for the gun. I was fortunate to be at the bombardment of Alexandria, and there was not one of those vessels that was penetrated through their armor, although there were many guns on shore that could do it, and they were struck many times. It does not make any difference what the nature of the armor is, for I think it is possible with 18 inch armor to keep out almost any projectile.

There is another matter in connection with this armor which I think looks well for the future. I think it looks as though we were going to be able to break the projectiles any way. The introduction of nickel plated armor plate has made a very material difference in that respect. In order to illustrate what I mean by that: If you will assume that the projectile energy necessary to penetrate a wrought iron armor plate is considered as 1, then the English Government experimental test would be represented by 7 per cent. greater; while the projectile energy which we used at Annapolis the other day was 17 per cent. greater; and I have seen a nickel steel plate fired at with a projectile energy of 30 per cent., and the plate did not crack, and the projectile did not get through. There is a possibility of hardening the nickel steel armor to a degree that we have not reached, and maintaining its tenacity; and as long as we do not crack the plate there is a possibility of stopping a hole, for you can plug them. But when the cracks pass from one hole to another you cannot do it—that is, provided the cracks go clean through.

Sir Nathaniel speaks of a solid body at the water zone in place of side belt armor. That is just now a most interesting thing in connection with the construction of men of war. They found that when the gun got so strong that it was almost impossible to keep the projectiles out, the next thing to be tried was to try to stop the inflow of water through the hole made by the projectiles. The French were the first to enter into this plan. They have adopted a material called cocoa-cellulose, which is made from the hair of the cocoanut. The war vessels are built double skinned, and this stuff is packed in tight. It is very light, weighing but 18 pounds per cubic foot, and costing but 17 cents per pound in France. They fill that in tight, and it is so wonderfully absorbent of water and so expansive that a 10-inch shot going through a 2½-foot plate of armor, the hole will close before half a dozen barrels of water can get through it. The French require that this hole shall stay tight for 18 hours, as they think by that time they can get to the inner skin and put a patch on the inside and then they are all right. The difficulty with that kind of material is that it goes on absorbing water, and it is necessary to subdivide the double skin of the ship by vertical compartments, and that adds to the weight. You must confine the flow of water to a short distance, and those vertical bulkheads add to the weight very materially, and are considered very bad.

In this country we have adopted the cellulose. The application of this to a man of war is quite simple, but when it comes to a merchant ship I question very much if we have not got to advance a great deal further, in connection with machinery, &c., before we can afford to have a merchant ship with a double skin all around. It takes too much horse hower to drive it. In these bigger ships it don't amount to much. But when they do have that material filled in it will add very materially to the life saving and preserving qualities of the ship. The armor trials which we had at Annapolis some time ago point very plainly in the direction of nickel steel. I think, from what I have seen, that it can be developed much better than what was exhibited there.

Sir Nathaniel gives his opinion as to what he thinks should be the disposition with regard to armor on men of war. He says that every ship which is intended for fighting purposes should have armor on it; I thoroughly agree with him in that. There is no question but what if you adapt armor to the construction of vessels specially for fighting purposes you can by the combination armor, even of this material, keep the water out of the shot holes, and you can produce a vessel which is almost impregnable and unsinkable, provided you go to 14,000 tons to do it. Then you do not get the unhandiness tha people talk about. Those vessels are handier than smaller steamers. You have the speed, and they will turn quicker. I think with regard to the matter of unarmored cruisers we are better off without any, for they are sure to get us into trouble in time of war. If we will develop our own commercial companies, encourage them to build steamers, and let them earn their own living in time of peace, and provide them with rapid firing guns in time of war, they will be more efficient than any unarmored vessels that you can make.

The paper by A. E. Seaton, on the

Development of the Marine Engine,

and the progress made in marine engineering during the past 15 years, was presented but not read, as all the time to be

devoted to this session had expired. In this paper he traces the development of the marine engine and its appurtenances and the general progress that has taken place in marine engineering generally during the past 15 years. The object is to show the important part taken by members of the Institute, in their various ca pacities, in this development. We make the following extracts:

The period chosen for consideration in this paper is one that embraces the genesis of the modern development of the marine engine and boiler; but it is, moreover, the time that has elapsed since the introduction of Siemens steel, to which I attribute much of the progress that has recently been made. Prior to that time, iron was used almost exclusively in the construction of marine boilers, and very little steel indeed had been used in the engine.

The supply of a material possessing all the good qualities of Lowmoor iron, without its bad ones, enabled Samson Fox, and subsequently others, to weld a cylindrical tube of almost any size, and so manipulate it by corrugating or raising ridges as to render it proof against the pressures we now require. That same material had an ultimate tensile strength fully 30 per cent. higher than that of the iron used in the boiler shell, and in addition was of such a nature as to permit of mannipulation unknown with that material, and its price is no higher than that of Staffordshire iron. A boiler made wholly of this steel was cheaper, lighter and better designed and manufactured than one of the older material when of the same dimensions and for the same pressure.

HIGHER SPEED.

So far this was the condition of affairs when fresh demands began to be made on the marine engineer. The shipping world had had demonstrated to it that it was possible to cross the Atlantic at a higher speed that 13 knots; and that the ships possessing this higher speed did their voyages regularly, and, according to rumor, were paying. Certainly, both the American and the British public showed preference for them, and there was a growing taste for speed at sea as there had been on land.

That demand was for more speed. Now, with the same conditions, more speed meant with any ship more indicated horse-power, more coal, larger boilers, and finally, to get the speed economically, finer lines; in other words, less ability to carry the heavier weights entailed by the greater power. The Arizona was the first supply to this new demand. Iron was the material used, the compound engine the moving machine. The result was a gain of 2 knots per hour, equal to 13 per cent., with an increase in coal consumption of 50 per cent.; the carrying capacity for the size of the ship was considerably less, the tonnage under deck being only 5 per cent. more.

In spite of all these serious disadvantages, the demand for such ships continued, so that the Arizona was soon followed by the Oregon and Alaska, still larger and faster ships. These were followed by the Servia, City of Rome and America. Then came the Aurania, Umbria and Etruria; and finally we have the City of New York, City of Paris, Teutonic and Majestic, of 10,000 tons, and doing 20 knots per hour on the Atlantic regularly. These were the supplies that marine engineers and shipbuilders gave to the demand for more speed. In 15 years the speed has been increased from 13 knots to 20, and there is no reason to doubt that these ships pay very well, in spite of their enormous cost and working expenses.

The competition among the various steamship companies running in connection with railway routes, and others in competition with railway routes, caused a demand for an increase of speed for a different class of ships. In fact, in every direction there existed a demand for more speed, so that there was every incentive to the shipbuilder and engineer to exercise his keenest wit in devising new ways of accomplishing this desirable end.

I have stated that one way of obtaining speed was by making ships with finer lines, and this had always to be done at a considerable sacrifice of carrying power. Steel has, however, to a large extent obviated the necessity for such a sacrifice. New methods of construction and new forms of material have also tended to this end. Ironmasters now supply at reasonable rates bars of **Z** section, whereby the framework of the ship is much lighter, and at the same time stronger, than the old combination of angle bars. Then, too, this splendid steel that you now give us is capable of being so flanged, and that, too, when cold, that there no longer exists the necessity of riveting to the plate an angle bar, if it is sought to stiffen it, or to connect it to other work. You supply us now with such materials at practically no extra cost, that we can construct our ships with much fewer plates, whereby we avoid the cost, weight and disadvantage of so many joints.

THE MARINE ENGINE.

But while admitting that the naval architect has done much to bring about a successful solution of the speed problem, I must maintain that the marine engineer has done more. His path was not so obvious nor so clear before him, and new openings have often shown themselves in unexpected places.

His first step in this direction was comparatively obvious. An engine develops so much horse-power at each revolution. If it can be made to do 60 per minute instead of 50, the gain in power is 20 per cent; and if the speed was at first 13 knots, it should now be 13.8 knots, or a gain of nearly a knot per hour. But how can we get this increase in the number of revolutions, and is it to be done economically? So far as the engines are concerned, it would mean an increase to the condenser only; and seeing that nearly all steamers at the date in question had too much cooling surface, it would probably have required no increase at all. But we must require more steam for this increase of power; certainly, and so the engineer of that day had to fit larger boilers to his ship.

Having accomplished so much as I have stated, it remained for the engineer to follow the path on which he had found so much success, and we soon found him running even these large engines at 80 revolutions. Taking, as before, the increased power as proportional—viz., 60 per cent.—the speed should now be 15.25 knots, instead of 13. Revolutions have now done for him as much as he thinks prudent, so he has to start in a new direction, and this time it is in the nature of an enlargement of the engines.

TRIPLE EXPANSION.

But before this climax has been reached a veteran engineer has turned once more to an old idea of his own. His first experiment with it had, through no fault of it or him, failed. He finds that with this new good steel he can now build a boiler of a type well-known and tried, and thereby get steam of the pressure he requires with certainty and safety; and in 1881 Dr. Kirk astonishes the shipping world by the success of the Aberdeen, having similar engines to the Propontis, made by him in 1874, but which failed. And why were the owners of ships so interested in the success of the Aberdeen, and what after all was her success? The steam pressure in her way was very little higher than some others were then using, being only 125 pounds, and at that time coal was as cheap as it had ever been; so that, although economy in its use was and always is of importance, it was not so much so as to cause a revolution so sudden and complete as that which followed. The fact is, here was the real solution of the speed question.

The failure, in 1874, of the Propontis was due to the want of a suitable material for boiler making, which by 1881 you gentlemen had supplied to us, and permitted such a success to her designer that the trade of the world has been thereby revolutionized. The saving of fuel has been stated, challenged, debated and discussed *ad nauseam*. The fact remains that it is substantial and is approximately 20 per cent. where all other conditions are the same. Experience has proved that the three crank engine is capable of being run at higher speeds than the two crank one, and that its wear and tear is absolutely less. The boilers being required to supply 20 per cent. less steam can, of course, be 20 per cent. less; or the same size of boiler will supply steam for 20 per cent. more power. This latter fact was the one made more use of by the generality of shipowners, partly by design, but oftener by unbelief. Hence the superior speed of many of the "tramps" is due to the latter; that of small passenger steamers almost wholly to the former.

FORCED DRAFT.

Mr. Thorneycroft, now so well known as the designer and builder of steam launches, and later of torpedo boats, soon had to give up non condensing engines and condense the steam so as to get fresh water for feeding the locomotive boilers he used. The loss of means of draft in the escape steam caused him to substitute artificial sources of air supply, and he found that by forcing air under the grates he could get an increase of steam supply over that given formerly by the steam blast. The pressure of air was increased from ½ inch to as much as 6 inches of water, corresponding to that of the fiercest draft of an express locomotive; the supply of steam was excellent, and the speed obtained with a steam launch of considerable size and torpedo boats larger still was very high, and was at the time considered marvelous. The means whereby these improved results were got were in themselves simple and inexpensive. The compartment containing the boilers was made air tight, and into it was forced a supply of air from the deck by means of one or more fans of the ordinary type, driven by an independent engine. The simplicity of these means and the success attending the experiments led our naval engineers in 1880 to adopt them on a large scale in some cruisers of the Leander class, the result being that with precisely the same engines and boilers, and with only the addition of the forced draft arrangement, a considerable increase of speed was achieved. Since that date similar forced draft arrangements have been fitted to all the new ships built for the British navy, and the example thus set has been followed by the engineers of other countries.

As an illustration of what can be done in this way, it is sufficient to instance the case of the first-class belted cruisers of the Immortalité class. When working under natural draft, the power to be indicated was 5500 horses, and on the trial trip as much as 6000 horse-power was developed. With forced draft, due to an air pressure equal to 2 inches of water, it was expected that 8500 horses would be developed by the engines; but, as a matter of fact, on the trial trip and under these conditions over 9000 horse-power was obtained, and

the speed was raised from 16½ knots to 19 knots.

In the days of natural draft and compound engines 10 horse-power per square foot of grate was thought to be a good output; with the introduction of the triple engine and higher pressures a natural draft would give 14 to 15 horse-power per square foot of grate; and the modern forced draft now in use in large ships enables us to get 20 horse-power per square foot of grate; and in smaller boats, where the air pressure in the stoke holes has been raised above 2 inches, even higher results have been reached.

WHAT HAS BEEN DONE.

To sum up, the three great developments of marine engineering that have been made in the past ten years are:

1. Increase in working pressure from an average of 75 pounds to an average of 150 pounds per square inch.

2 The adoption of the triple and quadruple expansion system, so as to utilize steam of this high pressure efficiently.

3. The adoption of artificial means for obtaining sufficient draft for the consumption of coal, and, when desired, for an increased consumption of coal, so as to give an augmented supply of steam without additional boiler capacity; with the result that in naval ships now with practically the same weight of machinery, the indicated horse-power is nearly doubled, and, in the mercantile marine, the indicated horse-power is 50 to 75 per cent. more for the same weight of machinery as was used 15 years ago, the consumption of coal being 20 per cent. less than 10 years ago, and 25 to 30 per cent. less than 15 years ago.

BETTER DESIGN AND WORKMANSHIP.

I now come to the progress that has been made by the marine engineer in the design and manufacture of machinery, whereby the engine of to-day, notwithstanding that it is lighter and even cheaper than that of 15 years ago, is worked with less wear and tear and fewer accidents.

That constant complaint of hot bearings has practically become a thing of the past is partly due to improved construction and better design, consequent on a better understanding of first principles; but good white metal has done almost more, as it has been found to be a panacea for the evil where it has existed for years in the older engines. The increased length of life of crankshafts is due to the absence of hot bearings, as well as to the lighter strains put upon them.

I would also express the opinion that the crankshaft of to-day is better made and of better material than was the case 15 years ago. Improved methods of manufacture of iron forgings, and the improved steel which you, gentlemen, give us, admit of a better surface, and the well made and heavy lathes of the present day can do the work not only cheaper but truer than was the case then.

In the construction of the modern marine engine the most marked feature of change is the quantity of steel castings introduced, sometimes in the place of forgings, sometimes in the place of iron castings and sometimes in the place of brass castings. Ten years ago my firm commenced using steel castings in lieu of iron ones for such parts as were subject to shock, and were of so plain a design as to be easily cast. We then substituted cast steel for forgings the strain per square inch on which was very light. For these purposes all we required was a material whose ultimate strength was at least 20 tons, and which, before breaking, would stretch at least 5 per cent. To-day we are constructing in the works of my firm (Earle's Shipbuilding and Engineering Company, Limited, Hull, England) engines of 12,000 horse-power in which the foundations, the whole of the columns, the pistons, the thrust blocks and collars, the eccentric straps, the cylinder and valve box covers and many other of the minor details are made of cast steel. The saving of weight is such that, taking one of these engines (they are twin screws) and half the boilers—that is to say, taking a set of machinery of 6000 horse-power—its weight is 560 tons, against 900 tons, the weight of a set of engines, boilers, &c., of 6000 horse-power made in 1870, and 1000 tons, that of compound engines in 1875, and which at that time were deemed to be the lightest of the kind, and were run at very nearly the same number of revolutions as the modern one. The ship for which our engines are intended is being built by us, and has a cast steel stem, a cast steel stern post, a cast steel rudder and cast steel propeller brackets, besides other cast steel fittings for gun and other purposes throughout the vessel.

The substitution of hydraulic presses for steam hammers, too, has not only improved the quality of the forgings, but most undoubtedly has been the means of reducing their price, and we now have steel crankshafts, steel propeller shafts, steel piston and connecting rods—in fact, every forging of steel in a war ship and in the highest class of mail steamers, and throughout the mercantile marine there is a general tendency to substitute this superior metal for the inferior. In H. B. M. Navy the shafting is made in accordance with the plan introduced by myself in 1872, whereby, by making the shafts hollow, a considerable reduction is effected in weight, with an exceedingly small reduction in strength. For example, a shaft 10¼ inches external diameter, with a hole 5 inches in diameter through it, is equal in strength to a solid 10-inch one, but its weight is only a little over three-fourths that of the solid one.

I do not suppose it is of equal interest to your Institute, but it is nevertheless a fact that very marked improvements have been made in the manufacture of bronze castings and also of bronze forgings. Fifteen years ago a gun metal casting, with an ultimate strength of 15 tons per square inch, and an elongation of 5 per cent., was considered satisfactory; but to-day we have the various bronzes, such as phosphor bronze, manganese bronze, Stone's bronze, aluminum, &c., having strengths varying from 20 to 30 tons per square inch, and in some instances even a higher ultimate tensile strength than 30 tons, with an elongation approaching that of steel. Forgings made from some of these metals have proved to be equal to steel in strength, and the cost of these bronzes is very little beyond that of gun metal.

TWIN SCREWS.

Propulsion by twin screws has many practical advantages, but it is chiefly now adopted from considerations of safety, inasmuch as a ship with two screws is less liable to have both injured at the same time, and therefore her whole propelling apparatus broken down, than one with the single screw; and in case of accident to the steering gear, she can be steered by varying the revolutions of the engines. Moreover, a smaller propeller is required for each of the twin screw engines than that needed for a single engine of same power; hence in the case of a deep draft ship, owing to the deep immersion, the twin screws work with a higher efficiency, and in the case of a shallow draft vessel the same holds good, inasmuch as they are thoroughly immersed when the single screw of the same power would be partly out of water.

USE OF FRESH WATER.

The adoption of steel boilers naturally suggested the advisability of using fresh water, not so much on grounds of cleanliness as of avoiding corrosion. This bugbear, however, has proved, like many others, not to exist. Experience has shown that the steel boiler does not corrode any more rapidly than the iron one; and, as a matter of fact, the life of boilers made of steel is likely to be very considerably longer than that of iron ones. The first steel boilers made by my firm 12 years ago are working at their original pressure, under the inspection of the British Board of Trade and Lloyds, and they are likely to continue to do so for many years yet to come. I am, of course, aware, and would remind you, that this increase of length of life is due in no small degree to the better treatment accorded to them. The use of zinc in the form of cast slabs or rolled sheets, especially in the earlier months of their life, has been the means of preserving boilers in a way not known before; and the general practice of causing the feed water to enter the boiler at a comparatively high temperature has also tended to increase their durability; but I repeat that under the same conditions the steel boiler shows no tendency to corrode any faster than the iron one, and the steel boiler has, besides, the advantage over the iron one of not developing blisters in the internal parts exposed to flame, so that the patching of furnaces is a comparatively rare thing now a days.

Alexander Thielen, member of the council of the Verein Deutscher Eisenhuettenleute, presided at the

Second Session.

In his speech he said in part:

By the courtesy of our American friends I am called upon to take the chair on the second day of our International Congress at Pittsburgh. Before proceeding to the formal part of the day it is my pleasant duty to convey the most sincere thanks to the distinguished society of the American Institute of Mining Engineers, who have given us this invitation to come over and take part in the discussion of papers, and who gave us an opportunity to see the vigorous iron and steel industries of this great country. The Verein Deutscher Eisenhuettenleute accepted this cordial invitation with the greatest pleasure; but we did not anticipate that the number who crossed the Atlantic would be so great. The 40 or 50 whom the most sanguine of our council expected to come over we are almost ashamed to tell you have risen to-day to the number of 142. We came to view and gain instruction by visiting your splendid works in all the various branches of the iron and steel industry which we have seen and which we will see, which shows that you are not only able to give the best record in respect of qualities, but you possess an abundance of engineering and mechanical devices which are a long way ahead of anything which we have seen in our home works. The riches which a kind nature bestows upon you were not neglected but turned to the most practical use. The liberality with which you have thrown open hundreds of your works; the great willingness which you have shown in answering our many embarrassing questions; the heartiness of our reception; the princely style of your hospitality, and last, but not least, the luxurious way in which we have passed 3000 miles in your country will never be forgotten by the Verein Deutscher Eisenhuettenleute.

Tunner.

At the conclusion of the president's remarks Dr. R. W. Raymond spoke feelingly of Peter Ritter von Tunner, who in 1840 had established what is now the Mining Academy of Leoben, in Styria, and to whom, more than to any other man, "it was due that that school has become

the central seat of the science of the metallurgy of iron in the world." Continuing, Dr. Raymond said in part:

And I count it a most fortunate and significent coincidence that this day, when we are gathered here in this amicable international conference, is the day when across the sea in Leoben the school which Tunner founded celebrates its fiftieth anniversary, and a few hours from this moment in which I speak another honorary member of the Institute of Mining Engineers, Professor Hoefer, of Leoben, will be delivering in that distant mountain town the jubilee oration in honor of Tunner and of Tunner's school. I have been honored by the privilege conferred upon me of making a motion that this meeting send a cable dispatch to Professor Hoefer, something that he can—I was going to say put in his pipe and smoke it—but that he can put in his address and speak it, when he addresses the congregation that will have assembled in celebration of that happy anniversary.

Dr. Raymond then read an interesting letter from Prof. T. Sterry Hunt, who was 35 years ago the colleague of Tunner and subsequently, on several occasions, his colaborer. His letter closed with the following:

And now in the fullness of time are gathered the representatives of three societies, one from Great Britain, one from Germany and a third, their friendly rival, all devoted to that profession which von Tunner had done so much to render illustrious, and each claiming him as an honorary member. And by a happy coincidence they meet in the great center of the American iron industry on the day when Leoben celebrates the jubilee of its world famed metallurgical school and of its founder, Peter von Tunner. What more fitting and proper than that we should send across the sea on this occasion our hearty greetings. I therefore venture to propose a telegraphic message from our international session, conveying our congratulations to von Tunner and to Leobon.

It was then moved to send the following message:

The International Session of German, British and American engineers and metallurgists send greeting to Tunner and Hoefer.

A paper was then read by Dr. Hermann Wedding, of Berlin, Germany, on

The Progress of German Practice in the Metallurgy of Iron and Steel Since 1876, with Special Reference to the Basic Processes.

This was an exhaustive and well illustrated paper which covered the subject thoroughly. We shall here only give the several subjects treated upon, reserving for an early issue a more extended notice with the engravings. The first division considers "Ores and Fuels," after which follow "Blast Furnace Practice," "Malleable Iron," "Ingot Iron," "Shafting" and "Chemical, Mechanical and Microscopic Investigations of Iron." It is impossible, by a mere enumeration of the principal titles, to convey any conception of either the scope or value of the contribution.

A paper by Alexander Thielen, of Ruhrort, Germany, was

On the Darby Process.

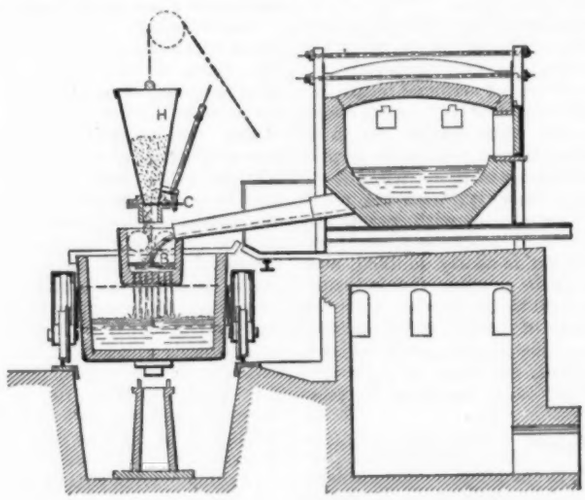
The paper describes the experiments made by bringing fluid steel into intimate contact with solid carbon. The resulting product is distinguished by its great toughness. The paper describes the methods of carburizing open hearth and basic Bessemer steel and details the results obtained.

While, by the old acid process the carburization readily takes place by the simple addition of spiegeleisen, &c., the basic process brought with it difficulties not easily overcome, inasmuch as the oxides which are always present in the basic process to a larger or smaller extent, and also the phosphoric acid of the slag take part in the reaction. The production of low phosphorus steel high in carbon cannot be accomplished readily, even by a partial removal of the oxide by pouring off the slag and a regulation of the amount left dissolved in the bath by so perfecting the process that there would be approximately an equal amount remaining in each charge, and even by diminishing the danger of rephcsphorization by as complete a removal of the slag as possible and by suitable slag additions made to the still remaining slag.

It can readily be understood, therefore, why after the introduction of the method of making steel in basic lined vessels proposals which have been formerly made for the introduction of carbon other than by the indirect way, by means of spiegel, &c., but which had hitherto remained without results, should be brought forward again from various quarters. All of these processes were based on the known fact of the great affinity between carbon and iron at high heats. It was sought to reduce and carburize the bath of steel by the introduction of carburetted gases, by the addition of tar, petroleum, &c., as well as many mixtures of these substances with solid bodies, such as burnt dolomite. However, the result of all these experiments did not lead to the permanent introduction of any of them in practical work until John Henry Darby, the managing director of the Brymbo Steel Works, succeeded in finding a solution of the problem.

Having attentively remarked an increase of carbon which took place in two pieces which had been treated in the coal fire for welding, he brought fluid steel into intimate contact with solid carbon, the result being a rapid absorption of the carbon by the steel. Supported by this experiment he founded on it his patented process by which fluid steel can be carburized by filtration through pieces of carbon, preferably in the form of graphite or wood charcoal, &c.

Further experiments showed that the absorption of the carbon was so rapid as to make the long time of contact unnecessary. Mr. Darby, therefore, constructed the apparatus figured in Fig. 1.



Fig, 1.

In this the cylindrical filter is replaced by the vessel B, which is conveniently supported between the open hearth furnace and the steel ladle, or between two other steel ladles. It is, like the filter, also lined with refractory material and is furnished with a perforated refractory bottom plate. Above this vessel is placed the receptacle H containing the roughly broken carbonaceous material. This receptacle is closed by a slide valve, C, by the opening of which the carbon is allowed to fall, slower or faster, as desired, into the vessel B, and there mixes up with the fluid steel, which is thereby carburized and flows out through the holes in the bottom plate. As a rule the carburization takes place during the first third of the charge. The remainder of the soft steel then mixes up with the already carburized steel in the ladle to a homogeneous whole The loss of carburizing material (graphite) by burning is about 15 to 20 per cent.; when coke is used for carburizing the loss is greater.

Mr. Darby's experiments extended wholly to the carburizing of open hearth steel, and he succeeded by his process in conjunction with the basic process in producing from phosphoric raw material a very excellent product, which with any desired percentage of carbon to upward of 0.9 per cent. contains only very small traces of other bodies, and consequently is distinguished from all hitherto known open hearth steel by its exceeding toughness. It has been worked up into chisels, knives, wire, &c., with the best results. And there was very great certainty in obtaining the right percentage of carbon, the percentage obtained varying from that aimed at, seldom more than 0.01 to 0.02 per cent. Although only very small additions of ferromanganese or ferro-silicon were made, it rolled very well. The process was very soon exclusively employed at Brymbo, for the harder steels, but in order to apply his system to the Bessemer process, Mr. Darby in 1889 entered into an agreement with the Phœnix Company, of Laar, near Ruhrort on the Rhine.

In the experiments in the Basic Bessemer works, the carburizing vessel was arranged between two ladles standing one over the other, and the steel carburized while streaming from the first into the second ladle by the stream of carbonaceous material. It quickly appeared, however, that the Basic Bessemer steel, although readily carburized, yet thereby lost its rolling qualities to such an extent that the ingots fell to pieces in the rolls. On inquiring into the cause of this, it was discovered to be due to the method of carrying out the process, viz: that for four minutes, more than sixty fine streams of steel were oxidized by means of the atmospheric oxygen. It was sought to

overcome this drawback, by replacing the 60 holes in the bottom of the vessel by one of suitable diameter. A considerable improvement in the rolling quality of the ingots was thereby produced. But the rolling quality attained was not equal to that of the ordinary Thomas ingots, and the apparatus was on this account superseded by the arrangement shown in Fig. 2. The carburizing vessel was replaced by the refractory line funnel open at the bottom, which was arranged between the casting ladle and the moulds. By an arrange-

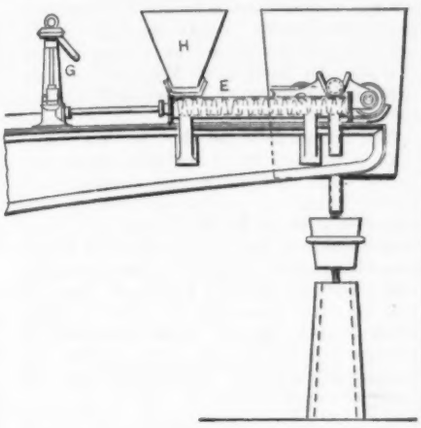


Fig. 2.

ment attached to the side of the casing crane it was possible to introduce into the funnel the ground carbonaceous material little by little in a well regulated stream. This arrangement consists of an accurately bored cylinder, E, provided with a lathe-cut worm, the receptable H and the turning arrangement G. As is readily apparent the amount of carbonaceous material forced out, is proportional to the number of rotations which the endless screw makes, which can be accurately regulated. By the employment of this apparatus the carburizing is safely done in the manner desired and good rolling ingots obtained. The ground coke appeared to be more quickly absorbed than the graphite, so that the whole of the experiments were carried out with this material. It was found that with ingots weighing 1.4 tons and measuring 16 inches square, the carbon was very equally distributed throughout. By some attention the frequently occuring increase of carbon in the top parts of ingots of this weight was successfully overcome by a lessened addition of carbon to the upper part. In order to test the equal distribution of the carbon, ingots were rolled down into 2-inch billets and tests taken from the two ends and the middle of the same.

Fig. 3 shows a second arrangement for carrying out this process. The carbonaceous material flows from the holder H into the fan wheel E. By turning the wheel by means of the winch G the filled compartments empty themselves and allow the carbonaceous matter to flow in regulated quantity into the vessel. The results obtained from the trial of this apparatus are given in Table 1.

Although this method of carrying out the process offered considerable advantages over the earlier way, yet it brought this disadvantage with it—that the accuracy and amount of the carburization was essentially dependent on the workman's rate of rotation of the endless screw. To effect the rotation by mechanical means appeared impracticable, because it must continually be brought into accord with the speed of the stream of molten steel, which varied according to the temperature and condition of the stopper hole. The observation that the carbonaceous material, finely ground coke, is immediately absorbed at the first contact with the molten steel, led to an arrangement by which this latter drawback was obviated. By the arrangement shown in Fig. 4 the carbonaceous material could be added di rect to the stream of molten steel flowing from the converter before it reached the ladle, while the slag could be retained in the converter until the carburation was complete, by means of a suitable plate lined with refractory material or by a block of refractory material. The quantity of the carbonaceous material flowing out from the receiver H is as before regulated by means of a slide valve. Some of the results obtained by this method are given in Table 2. In this way there was produced during the month of June at the said works 70 per cent. of the rail steel charges, also a number of charges for hard and welding Thomas steel, the whole of which gave satisfactory results. It may be remarked that with the carburizing process in the Thomas process the same addition of ferromanganese is required as for soft ingot charges or is necessary for the production of hard grades of steel with spiegeleisen.

After a series of very successful results had been obtained in this simple way the process was employed also in the open hearth and ordinary Bessemer practice. As was to be expected, the results obtained were so favorable that now the employment of the carburizing vessel has quite taken its place in these works. The advantages which this carburizing process offers in each of the methods for the production of steel are:

1. In the basic Bessemer (Thomas) process the carburizing takes place in the almost complete absence of the slag; rich in oxides and phosphoric acid, consequently it proceeds with certainty; it is accompanied by no important rephosphorization, and is practicable for any desired percentage without simultaneously increasing the manganese. By the omission of the spiegeleisen a considerable economy is effected.

2. In the Bessemer process the carbur ization takes place up to the highest grade of hardness with far greater safety than by the help of spiegel, and without the

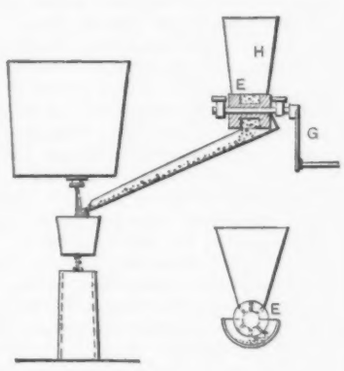


Fig. 3.

increase in manganese consequent upon the employment of the latter process. Here also a considerable economy is effected due to the saving in spiegel. The trials were made among others on some American works.

3. In the open hearth process for the acid and basic open hearth processes, the advantages obtained are very nearly identical with those mentioned for the Bessemer and Thomas processes, the very considerable cost of the ferromanganese and ferro-silicon especially, being wholly or for the greater part avoided. The combination of the process with the basic open hearth process permits of the production of a steel, which for many industrial purposes can successfully measure itself with crucible steel. By this method also a material is produced, which in the future will find very advantageous employment as the raw material in the crucible steel process.

For example: For the production in the basic converter of a rail steel of 50 (kgs. per square mm.) tensile strength there is required for the production of a charge of from 9 to 9.5 tons output:

(*a*) By the employment of the ordinary process:

Spiegeleisen, 10 to 12 per cent. .....600 kgs.
Ferromanganese, 60 to 65 per cent... 80 kgs.

(*b*) By the employment of the carburizing process:

Spiegeleisen.....nil.
Ferromanganese, 60 to 65 per cent... 80 kgs.
Coke..... 60 kgs.

For the acid process the calculation also shows itself in favor of the carburizing process.

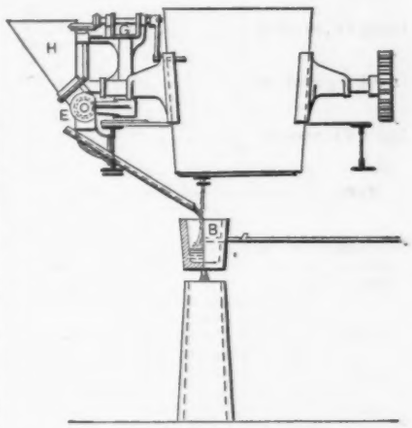


Fig. 4.

If steel of similar hardness is to be produced in the basic open hearth furnace, there is required for a charge of 10 tons output:

(*a*) By the employment of the ordinary process:

Spiegeleisen, 10 to 12 per cent.....250 kgs
Ferromanganese, 60 to 65 per cent... 80 kgs.

(*b*) By the employment of the carburizing process:

Spiegeleisen.....nil.
Ferromanganese..... 12 kgs. or less.
Coke..... .... 50 kgs.

The economy resulting from the employment of the carburizing process is here considerable; a similar relation holds good in the acid open hearth process. From the foregoing it is clear that the superiority of the carburizing process in regard to the question of cost becomes the more considerable the higher the grade of hardness of the material to be produced; to the advantage that the harder sorts of steel can be produced with far greater ease and safety. There is to be added the very considerable economy in the cost of production, while by the old process the cost of production rose considerably with the grade of hardness.

During the month of July there was effected in the carburizing process another modification, which considerably improved one of our leading articles, viz., tires. We use for the manufacture of tires small ingots, containing sufficient material for one tire, which after being hammered into flat disks are perforated in the middle, this perforation being enlarged before the disk is reheated before rolling. This method requires that the surface of the ingots is without any flaws, and it must be as well without any pores, as all these deficiencies can be seen afterwards in the finished tyre. The Siemens Martin steel obtained by the carburization process does not show immediately after the casting an absolute even surface. The carburized material was therefore not taken as material for tires.

Experiments were made to give the bath a small addition of aluminum and in consequence of this all difficulties were removed. By adding at the outside 0.04 per cent. of aluminum an ingot was obtained which was absolutely free from porosities, and eminently fit to be used for tires. Following up these experiments several solid castings were made out of the carburized material and these turned out equally satisfactory, being positively flawless.

Table I.—Showing the Carbon in Each Ingot, when Carbon was Added to Each Ingot.

		Percentage of carbon Desired.	Found.
Ingot I,	Section A.....	0.25	0.255
	B.....		0.260
	C.....		0.251
Ingot II,	Section A.....	0.25	0.244
	B.....		0.248
	C.....		0.254
Ingot III,	Section A.....	0.30	0.285
	B.....		0.311
	C.....		0.306
Ingot IV,	Section A.....	0.35	0.330
	B.....		0.324
	C.....		0.340
Ingot V,	Section A.....	0.35	0.350
	B.....		0.357
	C.....		0.352
Ingot VI,	Section A.....	0.45	0.461
	B.....		0.455
	C.....		0.470

Table II.—Carburized Basic Bessemer (Thomas) Charges.

Percentage of carbon before carburization.	after carburization.	Percentage of phosphorus before carburization.	after carburization.
0.073	0.285 first ingot 0.290 last ingot	0.040	0.040
0.070	0.268 first ingot 0.266 last ingot	0.052	0.070
0.082	0.293 first ingot 0.290 last ingot	0.045	0.054
0.078	0.301 first ingot 0.320 last ingot	0.038	0.046
0.080	0.274 first ingot 0.276 last ingot	0.049	0.049
0.091	0.315 first ingot 0.320 last ingot	0.074	0.085
0.083	0.298 first ingot 0.290 last ingot	0.063	0.072
0.095	0.274 first ingot 0.277 last ingot	0.048	0.049
0.072	0.284 first ingot 0.279 last ingot	0.055	0.067
0.083	0.269 first ingot 0.266 last ingot	0.042	0.050
0.089	0.300 first ingot 0.312 last ingot	0.044	0.056
0.077	0.323 first ingot 0.320 last ingot	0.073	0.075

Table III.—Carburized Basic Open Hearth Charges.

Desired % G.	Found before	After carburizing.
0.51	0.075	0.51
0.60	0.072	0.592 first ingot. 0.592 last ingot.
0.65	0.069	0.668 first ingot. 0.660 last ingot.
0.7	0.076	0.708 first ingot. 0.700 last ingot.
0.8	0.070	0.804 first ingot. 0.804 last ingot.

Table IV. — Carburized Acid Bessemer Charges.

Desired.	Found.
0.30—0.32	0.30
0.28—0.30	0.27
0.28—0.30	0.32
0.36—0.42	0.37
0.36—0.42	0.39
0.36—0.42	0.42
0.36—0.42	0.43
0.36—0.42	0.42

(Made by Carnegie, Phipps & Co.)

Table V. — Carburized Acid, Open Hearth Charges.

Desired.	Found.	
0.30—0.32	0.30	
0.28—0.30	0.27	
0.28—0.30	0.32	
0.36—0.42	0.37	
	0.39	
	0.42	
	0.43	
	0.42	
0.50	0.51	
0.60	0.592	Comencement of cast.
	0.592	End of cast
0.65	0.668	
	0.060	
0.7	0.708	
	0 700	
0.8	0.804	
	0.804	

Discussion.

P. C. Gilchrist said that while it is easy to make soft steel, it is very difficult to make steel with a regular percentage of carbon. He explains what was done at the Northeastern Steel Works (England), a basic Bessemer plant, with this process. He said:

In commencing the discussion upon this interesting paper, allow me to congratulate Herr Thielen on the very clear way in which he has put the matter before us. I fully indorse the necessity for the process. It is well known by all who have had anything to do with the basic process that it is remarkably easy to make very soft steel, and very difficult and requires a great deal of skill to make steel with a regular percentage of carbon over 0.15 or 0.20 at the outside. Consequently, when my friend Mr. Darby at the outset told me of his process I immediately went down to see it, and have followed it step by step with the greatest interest. You will remember, those of you who are conversant with the two basic processes, the basic open hearth and the basic Bessemer, that there were two discoveries required to perfect those processes—two discoveries in the case of the basic open hearth, and three discoveries in the case of the basic Bessemer process. This process of Mr. Darby's for giving a regular amount of carbon from 0.1 up to 0.9 or 1 per cent., is one of those discoveries. Mr. Darby carried on the process, as the author tells you, in the basic open hearth; and my friend Mr. Thielen was so satisfied with what he saw there that he thought he could apply it with success to the basic Bessemer.

RESULTS WITH A BASIC BESSEMER PLANT.

In July of this year my friend Arthur Cooper, the general manager of the Northeastern Steel Works, which you will remember is a basic Bessemer producing plant, producing some 3000 tons of basic ingots a week, went over with myself to Ruhrort, where we were permitted to see everything we desired to see, both the operation in the basic open hearth and also in the basic Bessemer. I will not weary you with the details of what we saw at that visit. They are much more clearly put in the paper that we have just heard than I could put them before you now. Briefly, I may say that everything that Mr. Thielen has stated in his paper we found ourselves when we made that visit. So satisfied was Mr. Cooper with the results that he saw obtained that within a very few weeks—I am speaking from memory, but I am inclined to think within a week of his return—he carburized some hundreds of tons by this method at the Northeastern Steel Company's Works; and I, knowing that this paper was coming on, asked him to be good enough to give me some results that might be taken as typical of all his results. To begin with, I may say that in one respect our experience there differs from the German experience. You will notice that the German experience shows a slight, but only a slight, recarburization. Mr. Cooper's experience, up to the time that I left England at any rate, showed that they had no recarburization at all. To that extent it is an improvement. In this letter of Mr. Cooper's, dated September 16th, he says:

In accordance with my promise, I hand you on the fly leaf the estimate of carbon in each of the nine ingots in blow 370 and in each of the eight ingots in blow 378, together with the phosphorus and the several manganese results. I also hand you the mechanical tests of rails made from the above blows, which you will see give exceedingly regular results.

I will not trouble to read you these; they will be handed in; but I will simply cite an example. In blow 370 they aimed at a carbon between 0.45 and 0.50. They got 0.44 of carbon as a minimum and 0.48 as a maximum in the nine ingots. The phosphorus in each ingot appears to be 0.06. The manganese varies from 0.58 to 0.69. The mechanical test for this charge was 13 feet long, 3 feet 6 inches bearing, 20 foot drop, and weight 1600. There were four blows. The first blow gave 1⅛ inches deflection, the second 1¼. The rail was then reversed and had two more blows, each of 20 feet, and it stood. The next blow that I have here is blow 378. The carbon aimed at was 0.30 to 0.35. The carbon obtained was, the lowest 0.27 and the highest 0.35. The phosphorus varied from 0.06 in the first, second and fourth ingots to 0.07 in the other five ingots. The manganese was 0.46 to 0.58. In the test of 378 there was at first deflection of 1⅛ inches, and then on reversing it it stood.

Mr. Cooper tells me that he has found that you have to be careful about one thing, and that is in the choice of the material that you use for carburizing. His experience so far has been that you must avoid material having much ash; choose something that has as little ash as possible, and especially as little oxide of iron. If you do that you will be able to obtain what I think is the right material, for instance, an alloy of iron, carbon and manganese, and get a material that will roll like copper.

G. J. SNELUS, OF WORKINGTON, ENGLAND,

said that there was now a prospect of producing a steel which would be of better quality than the famous tool and cutlery steel made from Swedish material, inasmuch as we can now produce a metal having less phosphorus than that celebrated product. He thought that the point of importance was that Mr. Darby had discovered that solid carbon would recarbonize steel.

The next paper was by Prof. John W. Langley, of Pittsburgh, on

International Standards for the Analysis of Iron and Steel.

Professor Langley presented a synopsis of his paper, from which we take the following:

The international standards for the analysis of iron and steel is an attempt in the iron and steel business to furnish analyses of ore or samples of metals whose composition has been determined by a large number of chemists in various countries, and the composition of which, therefore, may be taken as known beyond any reasonable dispute, and to these standards other accurately analyzed samples can be referred. I well remember when we first presented this subject, two years ago, the encouragement and support which I received in the plan from Dr. Wedding and from Professor Ackerman and from others. As the result of that to-day there are appointed in five countries committees who have in charge the furtherance of these analyses—those countries being Sweden, Germany, France, England and this country. Material for the international standards has been produced and distributed from this city.

DETERMINATION OF CARBON.

The present paper is not so much on the subject of these international standards proper, because they are now undergoing analysis by the respective committees just named, but the object of this paper is to call the attention of chemists to certain methods for the determination of carbon, which it is apparent, or probable at any rate, are subject to more or less variability. The committee in America held a meeting in Washington in the fore part of the

present year, and came to the conclusion that, before commencing the analysis of the international standards proper, as there was so much uncertainty and difference of opinion with regard to the best method of making the determination of carbon, and inasmuch as carbon is such a variable as well as important element in the constitution of steel, the committee thought they could wisely spend as much time as would prove to be necessary in an investigation of those methods of carbon investigation which are already well known, and are the methods practically in use all over the iron and steel world. The committee therefore decided to limit their investigations to

(1), The method in which the carbon is liberated from the steel by the action of a solvent, and then the carbon subsequently burned in a stream of oxygen; and

(2), To investigate the methods of burning carbon, which has been so liberated, in solutions of chromic and sulphuric acids—known respectively as the wet and the dry methods. In order that these analyses might be made on a sample of steel whose composition could be regarded as essentially uniform, the present speaker was authorized to produce what are known in his paper as the

EXPERIMENTAL STANDARDS.

The method of making the standards was to take a single crucible full of "dead melted" tool steel; put that into a single ingot; then drill or turn up the ingot into extremely fine particles, which were sifted in order to remove all the fine foreign matter, such as the wear of the drill or the dust which might get access to it; then these purified drillings were most thoroughly mixed mechanically, so that if there were any differences in the distribution of carbon in the original ingot (and those differences could only be very small from the nature of its production) they would be equalized by the mechanical mingling of the drillings. Those drillings were then distributed to the members of the committee. The committee show in the paper a record of a large number of very careful carbon determinations by the two methods indicated—namely, by the oxygen combustion and by the sulphuric and chromic acids method, and the results which they have reached may be very briefly referred to.

Taking up the first method, the chromic acid combustion (because that is the most briefly treated here), it was very early ascertained that the customary method of conducting the chromic acid combustion will uniformly lead to high results, owing to the evolution of chlorine from the carbon sponge, if that carbon sponge has been produced originally by treating with a solution of chloride of carbon or chloride of ammonium or of potassium. The cause of these high results was, I believe, ascertained several years ago by A. A. Blair, who attributes it to the passage of chlorine past the customary guard tubes in the form of a chloral chromic anhydrate or of oxydized chlorine. It was proved by this committee that a solution of sulphur with the anhydrous sulphate of copper, with all the usual precautions taken for the suppression of hydrochloric acid, will not suppress the acid when evolved from it in the form of a chloral anhydrate. The committee have succeeded in discovering a solution which will suppress this chlorine, and will therefore presumably give results which are entirely free from chlorine contaminations. Now, on the other and more important side of the subject, the committee believe that they have discovered that all carbon determinations which have been made by the use of the double chloride of copper and ammonium (and that represents to-day, I suppose, over 90 per cent. of all the methods of carbon determination which are made in this country; for, of course, the color method is ruled out from this work) are possibly called in question by the observations which the committee have made—namely, that the amount of carbon which is eventually obtained is a function of the mode in which that solution is manipulated. The co-operation of chemists all over the world should be invited to the solution of these very important questions: What is the proper mode of forming a double chloride solution? What are the sources of error in it? Should this double chloride be always made strictly neutral? Should it always contain a certain amount of free hydrochloric acid? Which of these methods is the correct one? Or, are neither of those methods correct? Or, is both of these sources of error, operating at the same time? Does a neutral solution dissolve a portion of the carbon, and hence always give too low results? Does an acid solution always precipitate out the dissolved cellulose, or some other form of carbon, in the solution? Are one or both of those causes always operating? Until that can be settled it appears to the committee that the subject of the determination of the carbon by the use of the double chlorides is necessarily held in a condition of doubt.

It is the present aim of the committee not only to continue the study of this particular subject, but to endeavor by all means to ascertain the quantity of carbon which steel contains by some other method which does not involve the use of the double chloride. Thus far they have not been able to produce a sufficient number of analyses by other than the double chloride method to make any authoritative statement upon this point.

Discussion.

G. J. Snelus said that in estimating carbon he had always used the direct method of burning the steel and burning the carbon with it. He felt there were great risks with the double chloride method. He thought that "if the steel is sufficiently finely divided and the heat is intense enough there is no difficulty whatever in burning all the carbon out of the steel by the direct method; and if that can be done it is perfectly clear that the collection of the products and the weighing of them forms no difficulty whatever. If you adopt the process of dissolving out the carbon by any such method as the double chloride, you naturally must lose something from various causes. I think that even the oxidation of the atmosphere has its effect. You cannot properly perform the operation without excluding the atmosphere. Then, again, we know that the common method of estimating the carbon by the coloration test shows us that this carbon which is deposited from steel is very easily dissolved under the conditions in which we use it there. I therefore cannot help thinking that the direct combustion method will be found in the end to be more accurate."

D. G. Lunge said, in continuing the discussion: "What Professor Langley has initiated is now being carried out in a number of the most important iron producing companies, and that is exactly what we have done on a small scale in Germany. Allow me to add one other word which illustrates the great benefit to be derived from this communion of ideas. I find in this paper a short paragraph which at once illustrates the difficulty that I have found to exist for a great many years past, and which has puzzled me considerably. In speaking of the methods of absorbing carbonic acid and removing the impurities connected therewith, he says that 'it was found that the anhydrous Cu So_4 would only stop H C^l when it was perfectly fresh, and in relatively large quantity, quite a small degree of hydration impairing its absorbing powers seriously.' Now, gentlemen, this is the method of Berzellius. He proposed the use of the anhydrous acids to remove the acid vapors of hydrochloric acid. For a great many years past I found that the results of the ordinary carbonic acid estimates not at all connected with the analysis of iron gave extremely satisfactory results, and, therefore, for very many years past I have given up the use of that anhydrous sulphate, and I have worked in other ways which I will not detain you to describe here."

Others took part in the discussion. The general conclusion appeared to be as expressed by Professor Dudley: "If any one six months ago had asked me to make a carbon determination of a piece of steel, and to testify in a court of justice that I considered the result reliable, I should have been perfectly willing to do so. But if to-day any of you metallurgists asked me how much carbon there is in a piece of steel, I should tell you that I cannot tell you. That is practically the state of affairs at the present moment. We have run across a possible source of error in one of our oldest and best established methods of chemistry."

The next paper was by J. Pohlig, of Cologne, on

Aerial Wire Ropeways.

This is a very complete description, illustrated by photographic reproductions, of the Otto aerial ropeways as constructed in Germany by the author. It is valuable, since it details the practice in that country, and thereby permits of comparison with the methods common here. Dr. Raymond pointed out the fact that the aerial ropeway is well known and extensively used in this country, both in permanent works, such as mining and transportation of material, and the building of such structures as dams.

T. Sterry Hunt, of New York, prepared an elaborate paper on the

Iron Ores of the United States.

He said that over 9,500,000 tons of pig iron were produced in this country during the year ending June 30, 1890, including about 500,000 tons from imported ores. Of this amount 99 per cent. came from ores mined east of the Mississippi, the remainder, with insignificant exceptions, coming from the State of Missouri, near the western bank of that river. He said that the iron industry is confined to the great region drained by the Mississippi and Ohio and their tributaries, and that, geologically speaking, the structure of this great interior region is as simple as it is geographically. The paper by Dr. Hunt gives in very complete form the geological formation of the iron ores of the United States.

After the usual vote of thanks to the local committee, proposed by Sir James Kitson, who said that the welcome given in New York by Mr. Carnegie had been more than fulfilled during the trip, and that everything had been freely and openly shown to the visitors, and after the Americans had been greeted with three rounds of British cheers and three rounds of German cheers, the meeting adjourned.

Excursions.

The Pittsburgh Reception Committee had prepared an elaborate programme of excursions, embracing all the principal points of interest in and about the city. Since they had, from an iron and steel point of view, perhaps the best source of supply to be found in any like area in the world from which to draw, they were enabled to prepare such a series as would fit all sorts and conditions of their visitors. On the afternoon of the 9th a special train conveyed a large portion of the visitors to the Wild Wood oil field, where they saw the, to them, strange sight of an oil well in all stages of evolution, some drilling, some pumping, some flowing, and, as a climax, one well was shot. The supply of gas and petroleum taken from the earth which the visitors found in and about Pittsburgh was perhaps the most interesting feature they had encountered so far, since it entered minutely into the manufacture of materials with which they were familiar, and since it was entirely different, because unknown, from anything they had at home. A second party visited the Pittsburgh Exposition, where the various products there shown were examined. Still another division went to Davis Island Dam on the Ohio. This dam was built by the Government to improve the navigation of the Ohio River, and is constructed on the Chanoine wicket system. This trip also permitted an examination of the connecting bridge over the Ohio River recently completed by the Keystone Bridge Company. Other excursions were as follows: To Wilmerding, where the extensive new shops of the Westinghouse Air Brake Company are located; the First Pool Monongahela Gas Coal Company, where the practical operation of coal mining by means of electricity was exhibited and where the visitors were shown appliances by means of which coal is delivered from the mine to the cars at a cost of 48 cents per ton. Then the plant of the Spang Steel and Iron Company, Limited, which was built in 1880, and which comprises three ten gross tons Siemens-Martin open hearth steel furnaces, seven heating furnaces, one hammer, four trains of rolls, one 30-inch bloom, one 30-inch universal, one 18-inch bar and one 113 x 31 inch plate roll. The product of these works is about 30,000 tons annually of steel boiler, ship and tank plate, and machinery and spring steel. Others visited the Westinghouse Electric Company, the Sable Iron Works, which were built in 1845, and consist of 28 single puddling furnaces, 11 heating furnaces and 6 trains of rolls, the product being merchant bar iron, including heavy sizes of flat bars and squares made on universal rolls. The annual output is 25,000 net tons. The Mackintosh, Hemphill & Co., Limited, works were also inspected. These works were built in 1826, the business then being that of general foundry work in a frontier town. The first locomotives built west of the Alleghenies and among the first built in the United States were here constructed between the years 1830 and 1840. The present line of work is heavy engines, rolling mill, blast furnace and similar works, many of the heaviest in the country having been made here. The plant is fully equipped in its foundries and machine shop. The Pittsburgh Steel Casting Company's plant was built in 1871, and consists of two 24-pot and one 18-pot Siemens steel melting furnaces, one 24-pot coke steel melting furnace and seven annealing furnaces. The product of crucible steel castings is 4000 tons annually. Other plants visited were Park, Brother & Co., limited, where the extensive equipment of open hearth and crucible steel work was shown; the Carbon Iron Company, makers of plates and bars for structural and general merchant work; the Pittsburgh Reduction Company, who are the only company in the United States manufacturing pure aluminum, the output being at the present time 375 pounds per day; the Kensington Iron Works, making bar, sheet and plate iron, flat and T rails, and using natural gas; Soho Iron Mills, having in the open hearth steel department an annual capacity of 18,000 tons of steel plate and 35,000 tons of sheet iron; the Linden Steel Company, Limited, making open hearth steel ingots, blooms and slabs, boiler, armor and ship plates, spring, tire and agricultural steel, the daily capacity being 75 tons; Singer, Nimick & Co., Limited, having a total annual capacity in ingots of 23,000 net tons, the product of the works being tool, boiler and agricultural steel; also carriage springs, axles and cold rolled steel; the Pittsburgh Iron Works, with a capacity of 40,000 tons, and making barrel hoops, cotton ties, lock iron, stone saws, &c.; Oliver Iron and Steel Company, who have two mills, consisting of 102 puddling furnaces, 30 heating furnaces, 14 hammers and 19 trains of rolls. The product here made is plate, angle and structural iron, the annual capacity being 120,000 tons. In 1884 two 2-ton Clapp-Griffiths stationary converters, producing Bessemer steel for miscellaneous purposes, were added. The annual capacity in ingots is 48,000 tons. The exclusive product of the Oliver & Roberts Wire Company is wire rods, the output being 40,000 tons. The plant consists of four trains of rolls. The American Iron works have an annual capacity of 175,000 kegs of cut nails and 200,000 net tons of iron and steel shapes; the La Belle Steel Works produce merchant steel of every description, the annual capacity being 15,000 tons.

The entire party was divided up, governed, of course, by their own inclination, and visited the above named works. The sight of an extensive plant making iron and steel and in which all the fuel was natural gas excited extreme wonderment. The opinion was expressed by one of our English visitors that in the handling of natural gas and coal fuel, and also in certain changes in the product produced, especially in rails, a large saving might be made. He thought that nature had lavished so much upon this district that the true economical principle in manufacturing had been lost sight of. He was led to this belief from the fact that in his own country and at his own works he was compelled by the cost, particularly of fuel, to be more careful of waste, and to hoard more zealously the fuel by which he made his iron.

In the evening a reception was tendered to the guests by the Duquesne Club. On the afternoon of the next day parties visited the Edgar Thomson Steel Works, of which we expect shortly to present a very complete description. This plant has an annual output of about 600,000 tons of Bessemer pig iron, spiegeleisen and ferromanganese. The sole fuel used is Connellsville coke. The Bessemer steel portion of the plant has a daily capacity in double turn of 1300 tons of ingots, 1000 tons of rails and 300 tons of billets. The only fuel used in heating the furnaces and under the boilers is natural gas. The Homestead Works have an annual output of 150,000 tons of Bessemer steel, 75,000 tons of open hearth steel ingots, 35,000 tons of steel plates and 115,000 tons of miscellaneous steel. Natural gas is here used exclusively. Other excursions were as follows: Pittsburgh Plate Glass Works, having a capacity of 60,000 square feet of glass per month at the works at Tarentum, the total capacity of the company's three works being 6,000,000 square feet per year. The Lucy furnaces of Carnegie, Phipps & Co., Limited, which have a product in Bessemer, forge and foundry pig iron of 150,000 tons; the Crescent Steel Works, which make a specialty of fine tool steel, and have a yearly capacity of 12,000 tons; Keystone Bridge Company's works, having a capacity of 16,000 tons of finished bridge material, and the Carbon Iron Company's works, having a capacity of 40,000 tons of plates and bars for structural and general merchant work. It was at these works that the visitors saw the direct process in operation.

At 6 p.m., Sunday, October 12, the party left Pittsburgh for Chicago.

Johnstown Industries.

The following data are from a little pamphlet presented to the engineers and metallurgists on the occasion of their visit to Johnstown on the 8th inst.:

The Cambria Iron Company were chartered in 1852 under the law authorizing the incorporation of iron manufacturing companies. The original purpose was to operate four old-fashioned charcoal furnaces in and about Johnstown, which was then a village of 1300 inhabitants. Since that time the scope and size of the works have increased until the present time, when the following brief description will give an idea of their appliances and product: The works of the Cambria Iron Company, in Johnstown, are known as the Cambria Iron and Steel Works, and the other the Gautier Steel Department.

CAMBRIA IRON AND STEEL WORKS.

At the northerly end of the works are the blast furnaces, known as Nos. 1, 2, 3

and 4, each furnace being 18 feet in diameter at the bosh and 75 feet high. These furnaces are supplied with blast by eight blowing engines, each 45 inches diameter steam cylinder, 84 inches diameter air cylinder, by 54-inch stroke. These engines were built by the company at their shops. The blast for these furnaces is heated by 12 brick hot blast stoves, each 19 feet in diameter by 70 feet high, and the steam for the engines is furnished by 40 double union boilers and eight water tube boilers. Three of these furnaces produce Bessemer iron for the steel works, while one is run on manganese ores for the production of spiegel and ferromanganese. The stock for these furnaces is delivered to their tops by three inclined hoists, the level of the stock house floor being about midway between the casting house floor and the furnace charging platforms.

Near the southeast corner of the works and against the hill are located two blast furnaces, known as Nos. 5 and 6, each furnace being 19 feet diameter at the bosh and 75 feet high. These furnaces are supplied with blast by six 84-inch blowing engines, the air being heated by four Cowper and four modified Whitwell hot blast stoves, the latter stoves, now about completed, being 22 feet in diameter and 80 feet high. The six blast furnaces at these works can produce regularly about 1100 tons of iron per day of 24 hours. Near the southwest corner of the works is the open hearth plant, where the finer grades of steel and steel castings are made. The open hearth department contains two 16-ton steel melting furnaces of the Pernot type, having revolving and removable bottoms. These furnaces are served by the usual hydraulic ladle and ingot cranes operated from a pulpit, besides which there is a large steam crane for pouring castings in a special pit.

In the open hearth building there is also a Krupp-Bell dephosphorizing or washing furnace, supplied with molten iron from two cupolas. The purified iron from the washing furnace is cast in chills and afterward used in the steel melting furnaces to produce the better grades of steel. Both the steel furnaces and the dephosphorizing furnace are heated by natural gas. The open hearth department produces about 100 tons of steel per day of 24 hours. North of the open hearth plant is the new Bessemer plant, containing two 12-ton vessels, with five large cupolas for melting iron and two smaller ones for spiegel. The ladle cranes and ingot cranes in this building are operated by hydraulic power, and all their motions —lifting, lowering, swinging and racking in or out—are controlled by the movement of suitable valves situated in two pulpits at the corners of the building. Air under a pressure of 25 pounds per square inch is supplied to the vessels by a large double horizontal Southwark blowing engine of special form, one of the features of which is the air valves with positive motion.

The air blast for the cupolas is supplied by eight large Baker blowers, and water under a pressure of 400 pounds per square inch is supplied to the hydraulic machinery by two large Worthington pressure pumps. The stock is lifted from the ground level to the vessel and cupola charging platforms by two hydraulic hoists. Vessel bottoms are lined up and repaired in a building adjoining the main building, and are carried and lifted by a hydraulic jack car running on a wide gauge track from the bottom house to the converting house under the vessels.

The steel ladles are dried and heated by natural gas, and are placed for this purpose on cars in an upright position under hoods of conical form lined with fire brick, the gas being delivered vertically downward, filling the ladle with flame if necessary, and performing the work in a very convenient way.

Quartz rock, fire clay and necessary refactory materials of good quality are obtained along the lines of the railroads within short distances of the works. The new Bessemer works produce about 1000 tons of ingots per day of 24 hours, and are so arranged that a duplicate plant of two vessels can be added on the north side of present plant. East of the open hearth plant is the blooming mill building, containing two two-high reversing blooming mills, one of 40 inches and one of 48 inches train diameter, each one being driven by a pair of large reversing engines. Either mill is capable of rolling into blooms all the steel ingots made by the Bessemer and open hearth plants.

In this building are six large four-hole vertical gas fired regenerative furnaces and three horizontal Siemens furnaces for heating the ingots, which are charged while still red hot. Each pair of vertical furnaces is served by a large steam crane for charging and drawing, while the horizontal furnaces are charged and drawn with the aid of hydraulic cranes.

In this mill the blooms are cut to length by horizontal shears, and are delivered thence by troughs leading to the ground level below, where they are loaded on cars for transportation to the various mills. Water under pressure of 400 pounds per square inch is supplied to the hydraulic machinery by two pairs of large compound pressure pumps located in the engine rooms adjoining the mill building. In this building are two steam hammers, one of 10,000 pounds and one of 5000 pounds, for cutting special lengths of blooms, while there is also a 650-pound hammer for making test bars from bloom crops.

North from the blooming mill is the large building containing most of the rolling mills. The eastern wing of this building contains what is known as No. 1 rail mill, with which the ordinary sizes of T rails are made. This is a 24-inch mill, with two three-high stands of rolls, one for roughing and one for finishing, the former work being done in general in six passes and the latter in five. These rolls are supplied with heated blooms by a train of driven rollers extending along the front of the four bloom heating furnaces, in line with the first pass of the roughing rolls. During the process of rolling the hot steel is handled entirely by machinery, a combination of lifting tables, with driven rollers, turning guides and a tilting transfer slide being used for this purpose. After leaving the finishing pass the rails are sawed hot, curved by a roller cambering machine, handled on the hot bed by driven rollers and chain conveyers, and straightened and finished in the usual way. Rails are rolled in double lengths on this mill.

The rail train is supplied with heated blooms from four large horizontal regenerative gas furnaces of the Siemens type, at present fired with natural gas. These furnaces are placed end to end in a row, with their fronts in line. Parallel with, and about 15 feet distant from, the front of these furnaces is a train of driven rollers, slightly elevated above the floor level, which conveys blooms to and receives them from a charging and drawing apparatus carried on a traveler, which moves along the line of furnaces.

The western wing of the rolling mill building contains another rail train, known as No. 2 rail train. On this mill are rolled street rails, and the smaller sizes of T rails of various sections, together with the larger sizes of angle splice bars and other shapes. It is a 21-inch mill, with three stands of three-high rolls, and is served by eight ordinary coal heating furnaces, which are at present adapted to use natural gas. The mill is driven by a 44 x 48 inch automatic engine.

Adjoining and in line with this last mill is the 12-inch mill, upon which are rolled plain and angle splice bars, light rails, angles, and various sizes of merchant bar. This mill is served by two ordinary coal heating furnaces, fitted for using natural gas.

In the small wing at the western side of the rolling mill building is a 16-inch mill with three stands of rolls. This mill is supplied with steel from two furnaces of the same type as those which serve the 12-inch mill. This mill makes splice and merchant bar.

Near the eastern end of the rolling mill building, in the wing extending in an easterly direction, are located two 21 inch trains, known as No. 3 and No. 4. No. 3 mill has three stands of three-high rolls, driven by a 40 x 80 inch automatic engine. Its product consists of the larger sizes of steel bars, rounds, squares, flats and billets. No. 4 mill is similar in construction and product to No. 3, but is driven by a 40 x 60 inch vertical engine. Each of these trains is served by six ordinary coal heating furnaces, with boilers located above them for utilizing waste heat. These furnaces are equipped to use natural gas.

In the rolling mill building there is also a 22-inch muck train, now used in rolling scrap bar. This train is served by three gas fired scrapping furnaces of the usual form. The northeast corner of the rolling mill building contains the rod mill. This mill produces wire rods by a continuous process; the rod being formed and reduced in cross-sectional area in several places at the same time.

At the northerly end of the main building containing the rolling mills is the axle plant, containing three hammers of 6000 pounds each and one of 15,000 pounds, all direct acting steam hammers. This plant contains five heating and two annealing furnaces for the manufacture of hammered steel axles, which are toughened by a patented process. At the northwest corner of the rolling mill building is the bolt shop, where are made various sizes of track and machine bolts. North of the bolt shop is the blacksmith shop, which contains four steam hammers of various weights, three small furnaces, together with the necessary cranes, blowers and other appurtenances.

North of the rolling mill building are the machine shops, foundry, roof shop, roll turning shop, boiler shop, car shop, carpenter and pattern shops, all fully equipped with necessary machinery. On the property of the company there are about 40 miles of railway track; the various parts of all the mills and shops are connected by narrow gauge tracks. Fourteen standard gauge locomotives and an equal number of small ones are used in handling material about the works. At the Johnstown works of the Cambria Iron Company, there are 280 steam boilers of various types in operation, in addition to which there are 61 others in use at the different tributary plants of the same company in Western Pennsylvania, besides a number at the now idle plants and others in process of erection.

The water supply for the works is obtained from three sources. There is a 36-inch main from the pumping station at Coopersdale, on the Conemaugh River, 2 miles below the works. At this station there are five pumps, with a combined capacity of 23,000,000 gallons per day. In addition to this there is a 16-inch main from the Laurel Run Dam, about 5 miles north of the works, and a 20-inch main from the Conemaugh Dam, on the Little Conemaugh, about 4 miles east of the works. The location of these dams is such as to give a head of 168 feet at the lower works.

Natural gas is largely used under the mill and shop boilers, and all the melting and most of the heating furnaces are sup-

plied with it. The gas is piped from the wells in the Grapeville field, about 40 miles west of Johnstown. In connection with the works is a physical testing laboratory—at present in temporary quarters. It is equipped with a 100,000-pound Olsen machine for testing iron and steel; a 1000-pound Fairbanks automatic cement testing machine, and apparatus for testing oils. A 300,000-pound Emery machine was also in use before the flood, and this machine is now being rebuilt and new parts being made to replace those lost.

GAUTIER STEEL DEPARTMENT.

The map with the pamphlet shows the location of this department of the works of the Cambria Iron Company. In these works a portion of the steel made at the lower works is still further finished and is made into the smaller sizes of merchant bar, plates, sheets and shapes, and again a portion of these is made into various forms for machines and agricultural implements, among which are cold rolled shafting, finger bars, plow coulters, harrow teeth and disks, rake teeth, plow points and cultivator teeth. The operations at the Gautier works are at present carried on in temporary buildings, pending the construction of a new plant to replace the one destroyed last year. There is in operation at these works at present a finger bar mill, a 9-inch, a 12-inch and a 20-inch train and two trains for cold rolling, with the necessary furnaces, shears and finishing machinery used in making the products above named. The Gautier Steel Department has also its own machine shop, pattern shop and blacksmith shop. This department now operates a mill at Cumberland, Md., pending the completion of its new works.

The company also own two blast furnaces at Hollidaysburg, one of which is in operation, and a blast furnace at Conemaugh, now out of blast. As a

RESULT OF THE FLOOD

of May 31, 1889, the main works of the company were overflowed and covered with *débris* to a depth of several feet and much damage was done to buildings and machinery. This damage was repaired and portions of the main works started at intervals of two to five weeks after the flood, the whole works being started early in July.

The Gautier Department buildings were entirely destroyed, and little left of the plant except foundations and heavy portions of engines and roll trains. Reinstalment of machines and building of temporary sheds, as at present in use, took about two months after starting of main works, most of the temporary plant being put to work in the month of September. The new buildings of a permanent and enlarged plant are now being constructed immediately west of the temporary plant. In their various departments the Cambria Iron Company employ more than 8000 men, and an estimate of the number of Cambria employees lost in the flood places it at 225.

THE MINES OF THE CAMBRIA IRON COMPANY.

The iron and steel works of the Cambria Iron Company draw upon widely separated parts of the country for the raw materials used. The coke comes from the Connellsville coke region, in Fayette County, Pa.; the limestone from Blair County, Pa, and the iron ore from the Menominee iron ore range of Michigan. The principal coke works owned by the Cambria Iron Company are situated from 1 to 4 miles south of Connellsville, on the eastern edge of the Connellsville field, 74 miles from Johnstown. They consist of 680 beehive coke ovens, distributed as follows:

Wheeler	100 ovens	11 feet in diameter.
Morrell	400 ovens	11½ feet in diameter
Atlas	80 ovens	12 feet in diameter.
Mahoning	100 ovens	11 feet in diameter.

These plants have an annual capacity of 390,000 net tons of coke, requiring 557,000 tons of coal. The coal is all mined below water level by slopes which follow the seam down from the outcrop. The seam varies in thickness from 7½ to 9 feet, and is almost free from slate and other impurities. Its dip is about 6° in a westerly direction. This coal makes a hard, bright, silvery coke, with well developed cells, making it a most superior blast furnace fuel.

At Bennington, on the summit of the Allegheny Mountains, 28 miles east of Johnstown, the Cambria Iron Company own 100 beehive coke ovens, the output of which is used at the Hollidaysburg blast furnaces. The coal here used for coke is mined from what is locally known as the Lemon seam. It is the Upper Freeport bed, or "E" seam of the coal measures. It is from 4 to 4½ feet thick, lies about water level, and dips westerly about 2½°. The coke produced is of an excellent quality, but is not considered to be quite as valuable a fuel for metallurgical purposes as Connellsville coke. The Bennington works can produce annually 55,800 net tons of coke, requiring 90,000 net tons of coal.

There is also mined at Bennington about 40,000 net tons of coal annually from the Lower Kittanning or "B" seam for steam and blacksmith purposes.

JOHNSTOWN COAL MINES.

Previous to the introduction of natural gas into the works of the Cambria Iron Company, in October, 1886, the company operated the following mines in the vicinity of Johnstown to supply the mills and works:

	Net tons.
Rolling Mill Mine, annual capacity	217,000
Coshun Mine, annual capacity	56,000
Lower Gautier Mine, annual capacity	30,000
Woodvale Mine, annual capacity	10,000
Conemaugh Mine, annual capacity	30,000
Total	343,000

The Rolling Mill Mine, the principal source of the coal supply, is in the Cement or Upper Kittanning seam, known as the "C" bed of the lower coal measures. This seam is about 3½ feet thick, lies very flat, and is about 60 feet above the Stony Creek.

The mine workings are very extensive, the area now mined out being 660 acres. There is an immense territory adjacent to the mine which can be depended upon to furnish a large amount of coal for many years. The Coshun Mine, situated opposite Woodvale, and nearly 200 feet above the Little Conemaugh River, now produces about 200 tons of coal per day for the use of the Gautier Works. Here the Upper Freeport seam or bed "E" of the coal measures is worked. It is about 4½ feet thick and affords an excellent steam coal. Lower Gautier and Woodvale mines, in the Lower Kittanning or "B" seam, immediately under the Coshun Mine, are small mines that have been closed since the introduction of natural gas.

The Birmingham Limestone Quarry, of the Cambria Iron Company, is situated on the main line of the Pennsylvania Railroad 56 miles east of Johnstown. It produces all the limestone used at the works. A Gates crusher, with a capacity of 1000 tons per day of ten hours, reduces all the stone to a suitable size for blast furnace use. A large air compressor and an extensive system of pipes furnishes power to the quarry drills. If necessary this quarry could produce 320,000 tons of most superior limestone per year.

The Cambria Iron Company also own and operate two ore mines at Springfield, in Blair County, where a deposit of brown hematite is worked.

The Cambria Iron Company own and operate four iron mines in the Menominee iron range of Michigan. These mines, the East Vulcan, West Vulcan, Cyclops and Norway, produce about 300,000 tons per year, which is smelted in the Johnstown furnaces.

THE JOHNSON COMPANY.

The Johnson Company's Works consist in general of the rolling mill, switch works and steel foundry. The rail train is of the two-high reversing type, driven by a pair of reversing engines built by W. & J. Galloway & Sons, Manchester, England, The various cranes, tables, saws, straightening presses and other machines about the mill are each driven by independent engines. The rail blooms are heated in regenerative furnaces, of which there are seven, and are conveyed directly to the first pass in the roughing rolls by a train of delivery rolls running in front of the furnaces.

Fuel gas, made by the Archer process from crude Lima oil, is used in these furnaces. Rails as heavy as 120 pounds per yard are rolled in this mill, the entire product being shapes of various kinds for street railway work.

Beyond the roll train are the hot saws, hot beds, straightening presses and finishing department. In this latter building are located the rail enders, slow speed cold saws, drills and punches for finishing rails to exact length, as required in cable construction. Outside the finishing department are the storage beds, loading racks and loading machines.

Adjoining the rolling mill is the switch works. This was the nucleus of the Johnson Company's works, and was formerly located in Woodvale. After their destruction by the flood they were rebuilt on their present location.

They consist of a bending shop, where all curves are bent, a machine, fitting and blacksmith shop, where under one roof all the various operations of making switch pieces and other special parts for street railway work are carried on.

Next to this building is the pattern shop and laying out floor, and adjoining this is the chair shop, where are made all the drop forgings used in the work turned out by this company.

Directly in front of the rolling mill is the steel foundry, where are cast the frogs, tongue switches and other switch pieces used in street railway work. In addition to this work, all kinds of steel castings are made, almost the entire product of this department being consumed by the company.

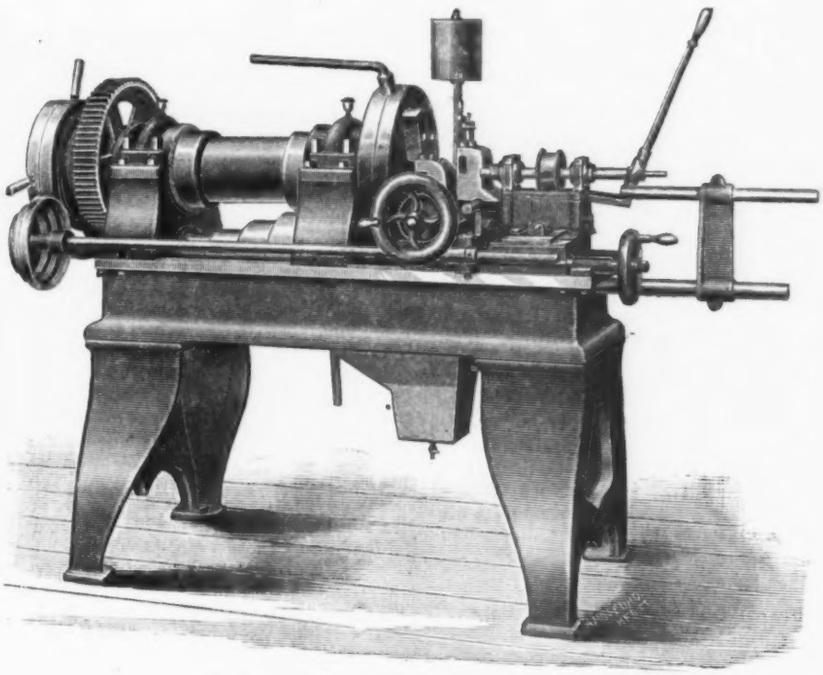
A. J. HAWS & SON'S ERICK WORKS.

are on the left bank of the Conemaugh River, opposite the works of the Cambria Iron Company. These works have an annual capacity of 10,000,000 brick—Bessemer tuyeres, bottom brick, stopper rod sleeves, ladle nozzles and different qualities of the ordinary shapes and sizes are made, most of the work being done by machinery.

The principal operations of brick making are carried on in four two story buildings, which contain the grinding, mixing and molding machinery and drying floors. Silica brick of excellent quality are made, the basis of which is crushed quartz rock obtained from quarries in the adjoining counties of Blair and Somerset. These silica brick are molded and pressed by machinery, and owing to their composition and method of manufacture are very dense and refractory. The capacity of this plant is now being enlarged by the addition of a two story brick building.

Cutting-Off and Centering Machine.

In this machine there are two tools working in the same cut; one presses up and the other down, thereby relieving the chucks and bearings of strain and leverage. One of the tools is intended to be ground V-shaped and the other square, as by this method the same amount of work can be done with less power and consequently with less strain on the tools and on the machine, since the V-shaped tool takes out the middle of the cut, leaving the other to take out the corners. In cutting-off rolls or studs a tool can be set in one tool block to bevel or round the ends. A patent nut on the back of the tool block enables the operator to make that tool block independent of the other and quickly set the tools to cut alike, even when the machine is running. The chips and oil are caught in a hinged receptacle under the machine, which drains the oil from the chips. The centering attachment is run by a separate belt and countershaft; it is conveniently arranged and easy to operate, and is so constructed that it is adjustable to the center of the machine in case the bearings wear. One advantage of centering with this machine is that the work can revolve while centering, which is sure to bring the center true. The machine we illustrate will cut rough shafts from ¾ to 5 inches in diameter. Other sizes are made by Hurlburt & Rogers, of South Sudbury, Mass.



CUTTING-OFF AND CENTERING MACHINE.

A Western journal gives a list of railroads aggregating 7667 miles of track which have been absorbed by purchase or lease by other systems within the past nine months, and states that never before has the march of railroad consolidation been as rapid as now. This statement conveys a wrong impression. The natural inference would be that consolidation at such a speed means a lessening of railroad competition. This is not the case. The lines which have been thus absorbed are not in any case competing lines with the roads which have gained control of them. They are all natural feeders of the controlling systems, or else form extensions which enable these systems to become more formidable competitors with other great roads. Under such circumstances competition for business may become keener than ever. The parallel lines are not consolidating, but are strengthening themselves for the great battle of the future.

New Chicago Factories.

The Columbia Steel Car Company have purchased a site for the erection of a plant for the manufacture of steel cars. It lies in the town of Maine, about 14 miles northwest of the city, and is located between the Northwestern and the Wisconsin Central railroads.

The A. Plamondon Mfg. Company have purchased 10½ acres in the western part of Chicago, on which they propose to erect works for the manufacture of pulleys, shafting, &c. They are now located on South Clinton street, between Madison and Monroe streets, but have found their quarters too cramped for their growing business. The land purchased has a double frontage on West Polk street, and extends from Harvard street to Lexington avenue and from Rockwell street to Washtenaw avenue. Plans for the necessary improvements include a three-story building on Washtenaw avenue, extending from Polk to Harvard street. A two-story building, or series of buildings, will cover the majority of the remaining property.

Negotiations are now under way for the location of a number of new factory interests in the manufacturing district between Cragin and Pacific Junction. The most important recent sale of property suitable for manufacturing purposes was made by L. V. Seinle to the Belding Motor and Mfg Company. This company have secured ten acres about three-fourths of a mile west of Pacific Junction and one-half mile east of Cragin. This property, including a brick factory, 80 x 430 feet and three stories high, was purchased for $67,000. The Belding Company will lease part of this building and fit up the remainder for themselves. It is expected that between 300 and 400 men will be employed in the manufacture of electric motors.

Westinghouse, Church, Kerr & Co., who have purchased the old Cragin plant, will refit it, and will employ about 100 men in the manufacture of engines and Roney stokers.

A site of five acres at the intersection of the Omaha branch of the St. Paul and the Northwestern railroads has been purchased by a company, who propose to erect a foundry and machine shop.

Plans are being prepared for a repair shop to be erected at Pullman for the Pullman's Palace Car Company. It will be 500 x 500 feet, two stories high and will cost $250,000. It will be thoroughly equipped, and will have steam heat and other conveniences.

NEW PUBLICATIONS.

WANT AND WEALTH. A Discussion of Some Economic Dangers of the Day. By Edward J. Shriver. G. P. Putnam's Sons. New York and London. 16 mo; p. 38.

This pamphlet treats of great questions very briefly—Why are we Poor? the Scylla and Charybdis of Socialism, the Tariff Question and the Single Tax. It takes the pessimist's view of the condition of people in America, which, we need not say, is essentially misleading and illusive, and from this standpoint argues against existing economic laws. The author assumes that poor people in great and disproportionate numbers cannot get work in this country. This is a misrepresentation of our condition unsupported by facts. An excuse for such statements can be found only in the crowded populations of a few great cities, in which 1000 idle people represent but a small percentage of its entire industrious population. The conditions of idleness and starvation in the country at large, or in nearly all the towns and cities, do not exist except in those isolated cases that are inevitable on account of sickness, obscurity, distance from help, sudden calamity or depravity. The author states what is also untrue, that the people cannot get land to cultivate, because it is held for speculation, near markets, when railroad lands are offered by millions of acres at $2.50 per acre and Government lands at $1.25 to $2.50 per acre in larger extents and in more desirable locations as to climate than ever before, without purchasers. The reason that land is not sought for cultivation is because we can raise now much more than the nation needs, and with the progress of civilization other nations are in staple products more largely taking care of themselves.

Mr. Shriver affirms that in these United States by the tariff laws the rich increase largely in wealth, and that the condition of the poor is consequently poorer. The very dependence upon labor of the numberless industries which are inspired by and contribute to increased wealth makes the statement as to the condition of the poor unreasonable, as it is unwarranted. The arbitary assertions of such thinkers on the side of economic reform do not establish the existence of any perils to the American republic which are not offset by general content and the marvelous prosperity of the whole people, as compared with other nations. The national domain contains more land than another generation, with its probable foreign increase, will wish to occupy. It possesses more resources of mine and soil, necessary for the maintenance of a great nation, than the people can possibly develop in another century, and for which there is no present need. We have a people so conscious of power and purpose to reform the current evils that come to the light in the changes and progress of society that the strength of this republican government against foreign importations of socialism and its threatenings of evil is not likely to yield or be finally overcome. For in our country national legislation effecting radical changes is of the nature

of a great experiment, that requires a long period for the elucidation of its wisdom in promoting or hindering the public welfare. The power of self control is the dominant feature of our national life. It has been strengthened by every great trial it has undergone, and the self reforming spirit of our institutions, political, moral and religious, which has been repeatedly manifested in great crises and needs of a change in the conduct of affairs, is the source of our present growth and the promise of future greatness and happiness.

FIFTEENTH ANNUAL REPORT OF THE CHIEF INSPECTOR OF MINES TO THE GOVERNOR OF THE STATE OF OHIO, 1889. 300 pp.; paper.

Ohio is not generally regarded as one of the mining States, but this report of Chief Inspector Robert M. Hazeltine makes a respectable showing of coal and iron development that compares favorably with her agricultural resources. The total coal tonnage produced in 1889 was 10,907,385 tons. There was a net loss in the product compared with the preceding year of 3561 tons. There were in operation 683 coal mines, employing 20,322 miners and 2972 outside hands. There was a slight decrease in the output of the Ohio iron mines for 1889. The total product in the 12 ore producing counties was 252,409 tons. In five counties there was a gain of 57,434 tons, and in seven counties a loss of 58,377 tons on the product of the previous year.

The great deposits in Ohio of fire clay have given the mining of this product great prominence. The entire yield for 1889 was 559,129 tons, which is larger by 87,335 tons than any previous year. These deposits are distributed over the counties comprising the Eastern part of the State. The manufactures of sewer pipe, paving brick, various wares and fire proof contrivances from this clay give great importance to this, among many other natural resources of the State. Limestone quarries and furnaces have also been as extensively worked as usual, employing 2681 men.

The paper on electricity in mining, with several full page illustrations of electric motors and tramways in the mines, is of special interest. There have been 230 accidents during the year in all forms of mining, of which 33 have proved fatal. The detailed reports of the mines have been made up from a total of 2000 visits by the chief inspector and five district inspectors.

The complete mining laws of Ohio, occupying 28 pages of this report, show considerable legislation which has yet failed to make the condition of miners satisfactory or equal to that of many other industries of the State.

PRACTICAL BLACKSMITHING. Compiled and edited by M. T. Richardson, editor of the *Blacksmith and Wheelright*; illustrated; vol. iii; M. T. Richardson, publisher, New York. Price, $1.

We have again to commend this series of practical articles, which have already reached many workmen through the columns of the journal to which they were contributed by experienced smiths and instructors. The present volume shows how blacksmiths' tools are made. An important chapter on welding, brazing and soldering is followed by one treating of steel and its uses and the processes to which it is sublected. Forging, chain and plow work also occupy considerable space very profitably in this book. Many important tools and processes are illustrated by clear figures, which, next to the models and shapes actually produced, will aid the learner very effectively. There is a good index for ready finding of the desired tool or other products of the forge and hammer.

AN AMERICAN GEOLOGICAL RAILWAY GUIDE, &c. By James Macfarlane, Ph.D. Second edition. Revised and enlarged. New York. D. Appleton & Co. 8vo.; pp. 426; limp cloth; $2.50.

The intelligent railroad traveler has often occasion in weary hours of long journeys to recall the regrets of Thomas Carlisle, that no one had made him acquainted in his youth with the grasses and roadside flowers, which seemed in his maturer years to ask for friendly recognition, nor with the names of the stars and constellations that looked down upon him from the evening sky, to whose salutations he could not respond. The study of geological formations is nowhere so interesting, so diverse and extensive as along the lines of American railways that pierce the soil and lay bare the strata of plains and mountain ranges of enormous extent. This geological guide is a companion that will profitably occupy many restless minds in such journeys. The study of the rocks was never contemplated among the wonderful sensations of railroad travel predicted by Stephenson to the English Parliament when he described the effects of a speed of 60 miles an hour on passengers whirled through a country. Yet here is a book which contains information that has required very many years for quick observers to gather. It has been drawn from the reports of State geologists, from books and magazine articles or matter still kept in unpublished notes. The railroad timetables are made to point to facts far more interesting than time figures and distances. The foot notes show instead of stage connections the situations of strata, the periods of geological formation indicated, or the deposits of minerals, metals and fossils of several thousand localities. The outlines of geology in any section thus described can be rapidly compared with the standards of geological divisions which Prof. J. D. Dana and Dr. T. Sterry Hunt have published. The elements of geology are contained in the 50 introductory pages, and the practical work and observations of numerous investigators are made to illustrate them in a profitable and interesting manner.

Natural Gas Companies and Their Profits.

The reports of the various natural gas companies of Pennsylvania which have been filed with the Auditor-General of that State make the following showing:

The report of the Western Pennsylvania Natural Gas Company, of Pittsburgh, shows that for the past year no dividend has been declared; thier capital stock is $5000, on the appraised value of which, $500, was levied a tax of 3 mills. The Torrens Gas Company, with a capital stock of $15,400, declared no dividends during the past year; the appraised value is $5120, on which was levied a tax of 3 mills. The People's Natural Gas and Pipeage Company, of Pittsburgh, have a capital of $300,000. On January 10, March 18, June 17 and September 16, 1889, a dividend of 2 per cent. was declared. The gross earnings of the year were $60,608.88; the net earnings, $46,675.38. The Westmoreland and Cambria Natural Gas Company have a capital of $2,000,000; 2½ per cent. dividends were declared four times during the year. The Versailles Fuel Gas Company have a capital stock of $250,000; no dividends were declared last year, as the company did no work. The Fort Pitt Natural Gas Company have a capital stock of $250,000; no dividend was declared last year; there was a loss of $3,357.54. The Meadville Natural Gas Company, of Oil City, have a capital stock of $100,000; four dividends of 1½ per cent. were declared. The Fayette City Natural Gas Company have a capital stock of $10,000; an 8 per cent. dividend was declared last year; the gross earnings were $4501.24; net earnings, $1347.79. The Independent Natural Gas Company, of Butler, have a capital of $10,000; no dividend was declared.

The Kitanning Consolidated Natural Gas Company have a capital stock of $135,000; three dividends of 1 per cent. were declared. The Carpenter Natural Gas Company have a capital stock of $10,000; surplus for the year, $2,933.33; no dividend declared. The Ten-Mile Oil and Gas Company, of Washington, Pa., have a capital of $25,000; no work was done last year. The Meadville Fuel Gas Company, of Washington, Pa., have a capital of $100,000; dividends of 1½ per cent. were declared last year. The Bellevue Natural Gas Company, capital stock $50,000, was consolidated last year with the Bellevue and Glenfield Natural Gas Company. The Tionesta Gas Company have a capital of $50,000; gross earnings for the year, $5668.16; net earnings, $2222.86. No dividend declared. The Manufacturers Gas Company, of Pittsburgh, have a capital of $600,000; gross earnings for the year, $207,612.90; net earnings, $123,328.86. No dividend declared. The Greenville Natural Gas Company have a capital of $50,000. Did no business last year. The Youghiogheney Natural Gas Company have a capital of $180,000. A dividend of 6 per cent. was declared. Gross earnings, $21,169.99; net earnings, $12,867.57.

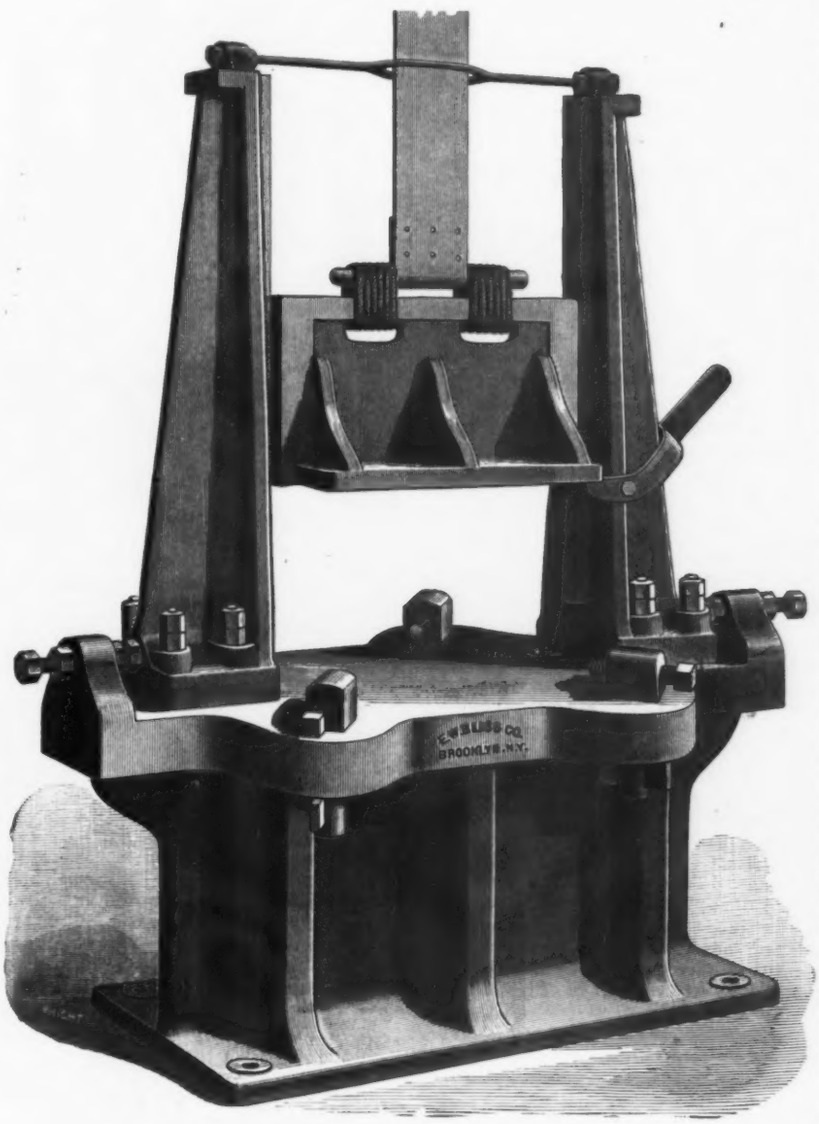
The Natural Gas Company of West Virginia, of Pittsburgh, have a capital of $1,000,000. A 4½ per cent. dividend was declared. Net earnings for the year, $45,000. The Southern Natural Gas Company, of Pittsburgh, have a capital stock of $1,000,000. No business has been done as yet. The Duquesne Natural Gas Company have a capital stock of $10,000; gross earnings for last year, $19,644.26; net earnings, $16,992.15; no dividend declared. The Bellevue and Glenfield Natural Gas Company have a capital of $70,000; no dividend declared last year. The Northwestern Natural Gas Company, of Oil City, have a capital of $265,000; four dividends of 1½ per cent. each were declared. The Keystone Natural Gas Company, of Parkers, have a capital of $10,000; a dividend of 6 per cent. was declared; gross earnings, $14,529.41; net earnings, $3374.65; undivided profits, $5050 20. Lock No. 4, Natural Gas Company, capital, $5000; a dividend of 6 per cent. was declared. Taylorstown Natural Gas Company, of Pittsburgh, capital, $100,000; no business done during the year. Brownsville Natural Gas Company, capital, $65,000; a dividend of 2 per cent. was declared; gross earnings, $8002.61; net earnings, $5520.33. The Independent Natural Gas Company, of Sewickley; capital stock, $40,000; no dividend declared during the year.

Fire proof school buildings constitute a very desirable feature in the latest improvements. The building to be erected on Hester and Christie streets, New York, will be of this character. Iron beams and girders will be used, and these will be surrounded by other fire proof material. They will rest directly upon the brick walls, while the spaces between the different beams will be filled in by fire proof arches. Fire proof partition blocks will constitute the partitions between the rooms, and, in fact, the only combustible material in the building will be the desks, window sashes and wooden floors. The boards, however, will be laid upon the still soft cement, and, the air being expelled, it will be impossible for the fire to spread along the floors. The entire cost will be about $250,000.

The appointment of James F. Goddard as Commissioner, to succeed Albert Fink, was ratified by the trunk line presidents.

Cornice Makers' Drop Press.

The drop press here illustrated is designed by E. W. Bliss Company, Limited, of Brooklyn, N. Y., for stamping or embossing and paneling large sheets, such as are used by cornice and ceiling makers. This work requires a very roomy but at the same time a not very heavy machine. In the design shown the width between housings is 32 inches, and the poppet screws will accommodate a die 28 x 24 inches. The housings are fastened to the



CORNICE MAKERS' DROP PRESS.

bed by means of bolts, the heads of which are held in T slots, so that the housings may be adjusted to receive a much narrower hammer, which is very convenient where it is desired to use small dies, as the weight of the hammer can be correspondingly reduced. The hammer, as shown, weighs 900 pounds, and has a face 24 x 30 inches. In order to obtain these large dimensions, without too greatly increasing its weight, it is made of cast steel, thus giving the necessary strength. Owing to the peculiar nature of the work to be done, which consists in "coaxing" the metal into the die—that is, striking a succession of very light blows in order to gradually force the metal down, and then finishing with the full force of the hammer—it is necessary to raise the latter by means of a belt passing over a pulley revolved by power, the slack end being handled by the operator. Experience has shown that this is a more satifactory arrangement for this class of work than any automatic lift, as the latter is not controllable with sufficient accuracy. With a pulley running at the proper speed, 1000 pounds weight may be lifted very easily. The speed of the pulley rim should be not more than 3 or 4 feet per second, and, contrary to a very prevalent idea, the weight may be lifted quite as easily with a pulley of small diameter as of large. In fact, the smaller the pulley the better, the limit in the lower direction being the flexibility of the belt in passing over it. The total weight of the machine shown is 9500 pounds

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The Rounds & Anderson Foundry Company have purchased 25 acres at the northwest corner of Stony Island avenue and Ninety-second street, Chicago, on which they will at once erect works which will employ 1200 men. The price paid for the land was $3550 per acre.

Wm. H. Webb, of New York, the builder of the steam frigate General Admiral of 7000 tons, and of the steam ram Dunderberg, also of 7000 tons, remarks upon the progress made in steam navigation in the last 30 years. The former arrived in Cronstadt, Russia, in 18 days from New York, and the latter reached Cherbourg in 14 days from New York, under steam alone. Their boilers were not built to carry over 60 pounds of steam, the engines making only 60 to 62 turns of a single propeller, whereas we now see the largest class of steamers, both naval and commercial, fitted with boilers affording 90 to 100 pounds of steam, and machinery giving 90 turns to each of two propellers, and obtaining 19 to 20 knots an hour.

SOUTHERN MISCELLANY.

The new furnace of the Rome Furnace Company, of Rome, Ga., is nearing completion, and it is now announced will go into blast on December 1. This furnace is said to be a model in its construction. It is an 80 ton charcoal furnace. The company own several thousand acres of iron land near Rome.

The Chattanooga Furnace, at Chattanooga, Tenn., is preparing to be blown out, with a view to undergoing repairs. This plant has been averaging a daily output of 60 tons of best foundry pig.

At Birmingham the capital stock of the Henderson Steel Mfg. Company has been increased by $100,000, which will provide funds for the construction of two more 10-ton fur furnaces.

The New Orleans Agricultural Works, Limited, have been incorporated at New Orleans, with a capital stock of $30,000. The incorporators are: Albert Baldwin, Sr.; Albert Baldwin, Jr., and W. Y. West.

A syndicate of northern capitalists are negotiating with parties in Dallas, Texas, looking to the establishment of a car works in that place that will cost $500,000.

The Embreeville Iron Company, of Embreeville, Tenn., have awarded a contract to the Pittsburg Iron and Steel Engineering Company, of Pittsburgh, Pa., for the erection of an iron furnace, and work is to be begun shortly.

It is stated that a Pennsylvania iron foundry is in negotiation with a manufacturing and development company, of Frederick City, Md., for the transfer of its plant to that place.

Inducements have been offered H. J. Mitchell, of Lehigh, Pa., for the tranfer of his car springs works, to Anniston, Ala., and it is stated in the latter place that he will probably close the negotiations favorably.

The South Tredegar Iron Company's spike mill, at Chattanooga, has been running a double force for some time, but has not yet caught up with the orders. This plant's angle bar mill is running single turn. The new furnaces and beaters are in full blast, and the nut and bolt works are behind on orders for railway track bolts.

At Florence, Ala., the Ohio Mfg. and Investment Company, recently organized, have made extensive purchases of mineral and timber land and town site property. This company purchased 5000 acres of mineral land in Wayne County and 2000 building lots in Florence. The entire purchase requiring an outlay of $500,000.

Ironia is a new iron town to be built in Sabine County, Texas, by the Sabine Land and Mining Company. A number of iron industries are in contemplation, including a furnace, rolling mill, &c.

A company are reported organizing at Piedmount, Ala., for the purpose of manufacturing a newly patented covering for boilers and steam pipes. The principal promoters of the enterprise are G. E. Wheeler and J. C. Keifer, of Wilmington, Del.

A round house and car shops are to be erected at Fountain Head by the Fountain Head Railroad Company.

The Southern Manganese mines, at Cushman, Ark., have 110 men at work, and are shipping eight carloads of manganese per week to the Illinois Steel Company, at Chicago.

The Llano Improvement and Furnace Company, of Llano, Texas, have increased their capital stock from $1,500,000 to $3,000,000.

The work of erecting the new tack factory buildings at Harriman, Tenn., has commenced and will be rushed to completion with all possible speed. The machinery of the tack making plant of Fosgate & Lane, Auburn, N. Y., will be removed to Harriman in time to enter the new buildings on their completion.

Grand Rivers, Ky., is looming up as an iron town of considerable importance. The Burgess Steel and Iron Works have awarded a contract for the construction of a 60-ton furnace, and it is statod that another furnace of like capacity will also be erected by the Ports-

mouth, Ohio, Iron Machine Company. The latter company have recently contracted for the erection of boiler works and machine shop plant at Grand Rivers. This plant will be a branch of the Portsmouth establishment and be known as the Union Structural Iron Works.

Capitalists from Philadelphia have recently organized a company for the development of Cedartown, Ga., under the name of the Cedartown Land Improvement Company. Polk County, in which Cedartown is situated, is rich in iron ore, the pig iron manufactured from it commanding a higer price per ton than other iron, and it is claimed that more of it is shipped from Cedartown than from any other place in the South, except Birmingham. There is nearly $2,000,000 represented in the mining companies in that vicinity, and the Cherokee Iron Company have been in operation some time. The capital of the Cedartown Company is $250,000, of which $150,000 is paid in. The officers are: Pretident, E. M. Wistar, of Philadelphia; vice-president and general manager, J. K. Barton, Cedartown, Ga.; secretary and treasurer, Charles Adamson, of Philadelphia. The Board of Directors includes, besides the officers: A. H. Merritt, of Reading, Pa.; U. B. Crenshaw, Albert H. Carson, Philadelphia; J. H. Hoffsecker, Jr., Wilmington, Del., and L. B. Tredaway.

One of the largest purchases of ore lands ever recorded in the South took place recently at Talladega, Ala., Gordon McKay paying $60,000 for the Reynolds Whiting ore banks near that town. Mr. McKay is a capitalist of Newport, R. I., who will organize a company and erect an extensive mining plant on the property, and engage extensively in the ore business.

The Wills Valley Mining and Mfg. Company have been incorporated at Attalla, Ala., by J. S. Steward, T. C. Galloway, W. O. Peebles, of Chattanooga, and others. The company will have a capital stock of $100,000, and their objects are the working of iron mines and the establishment of a furnace.

Kensington is a new iron manufacturing town in Georgia that is displaying a good deal of activity at present. Messrs. Lilley & Hillsley, of Philadelphia, are preparing to establish an iron foundry, a rolling mill and a nail works at that point, and other parties contemplate the erection of an iron furnace.

It is reported at Sheffield, Ala., that Alfred Parrish is negotiating with Enoch Ensley for the purchase of the Lady Ensley and the Hattie coke furnaces, also large tracts of iron ore properties in Franklin County. The price demanded for these holdings is said to be $1,500,000.

At Chattanooga, Tenn., a 50-foot addition has been built to the carpenter shop of the Wheel and Foundry and Machine Company, and a 70-foot addition to the machine shop has been commenced. The Chattanooga Plow Company have recently finished the erection of an addition to their plant.

The work of erecting the immense buildings for the South Boston Iron Works has commenced at Middlesborough, Ky. The main building is 1200 x 150 feet in dimensions.

The South Pittsburg, Tenn., Furnace Company, are preparing to put in two new Weimar blowing engines, steam cylinder 50 inch, blowing cylinder 90 inch and a 60-inch stroke.

It is stated that the Mount Joy Novelty Iron Works, of Mount Joy, Pa., are to be moved to Frederick, Md.

The Union Ore Company, with $50,000 capital stock, have been incorporated at Monroe, N. C., by H. E. Eames, J. E. Pearson, F. A. Forch and others. This company propose opening mines and selling mineral lands.

The Louisville, Ky., Pipe Bending Company announce their intention of enlarging their plant by the addition of heavier punch and shears, rolls for boiler work and other machinery.

The Brunswick (Ga.) Foundry and Machine Works will rebuild their machine shops and foundry, recently burned.

The stove works of the Fort Payne (Ala.) Coal and Iron Company have been capitalized at $60,000 under the name of the Fort Payne Stove Works. The officers are: W. P. Rice, president; F. H. Tobey, vice-president, and W. P. Hemphill, secretary.

The Rockwood Stove Works, of Rockwood, Tenn., with $75,000 capital stock, have bought the Miama stove foundry and will operate it.

A company is said to be organizing at Dalton, Ga., for the purpose of establishing car wheel works.

The West Point Mining and Mfg. Company have been incorporated at West Point, Tenn., to develop iron ore properties in that vicinity. The company will have a capital stock of $40,000. Among the incorporators are O. J. McGarry and W. A. Hudson.

A company is organizing at Carrollton, Ga., to build a foundry and machine shops at that place.

An agricultural implement works will be among the new enterprises to be soon established at Cordele, Ga.

The Little Belle Furnace No. 5, of the De Bardeleben Coal and Iron Company, at Bessemer, Ala., is preparing to go into blast about the middle of the present month. The No. 4 furnace of this company, called the King John, was blown in on the 15th ult. It had been completed several months before, but was delayed in going into blast because of difficulty in getting in sufficent supplies of ore and limestone. This furnace is 65 x 17 feet, and was built for an output of 100 tons, but during a recent run it turned out 115 tons. It is equipped with the most modern furnace appliances and stands 26 on the number of furnaces in the Birmingham iron district. There are 300 coke ovens, six blowing engines and six Whitwell improved stoves in the plant.

Shears for Cutting Sheet Metal.

In Fig. 1 of the accompanying illustrations we present a front view of a machine designed for cutting, at one operation, from sheet metal, parallel curves such as pan sections, which is being offered to the trade by the Peck, Stow & Wilcox Company, with works at Southington, Conn., and New York office at 27 Chambers street. Reference is made by the manufacturers to the fact that these shears can be readily adjusted for parallel curves of any ordinary flaring vessel, and that their use results in a saving of both time and labor. Machine No. 1 will cut segments of circles from 6 feet in diameter down to 9 inthes, with a range in width from 12 inches to 3¾ inches. What the manufacturers designate as the No. 2 shear will cut segments of circles 12 feet in diameter down to 9 inches, with the same range in width as indicated in connection with machine No. 1. The shears are made under Lowe's patent. The manufacturers state that the arrangement is such that they can very readily annex an attachment for cutting plain circles at a cost varying according to the circle to be cut.

In connection with this machine it is interesting to refer to Lowe's Patent Beveling Shears, manufactured by the same company. This device is indicated in Fig. 2 of the illustrations, and is intended for cutting, at one operation, and at any desired angle, the ends of pan sections after they have been cut by means of the parallel shears shown in Fig. 1. This machine is made in two sizes, No. 1 having 10-inch blades, while No. 2 is provided with 12-inch blades.

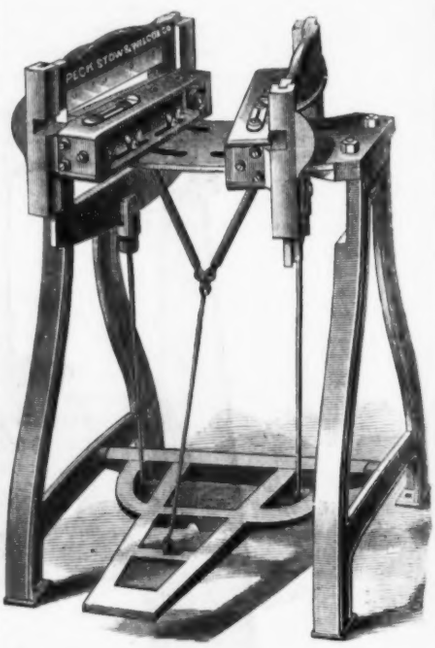
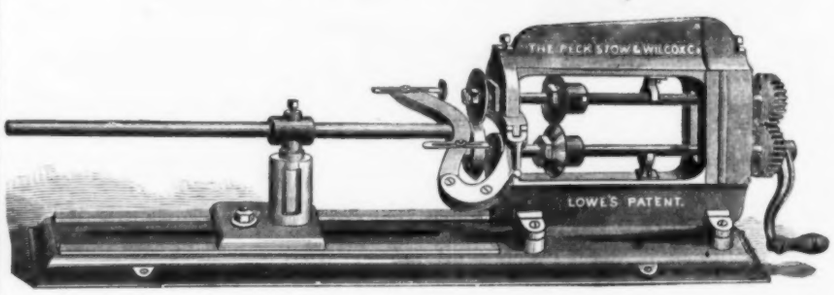


Fig. 2.—Beveling Shears for Cutting Ends of Pan Sections.



Shears for Cutting Sheet Metal.—Fig. 1.—Shears for Cutting Parallel Curves.

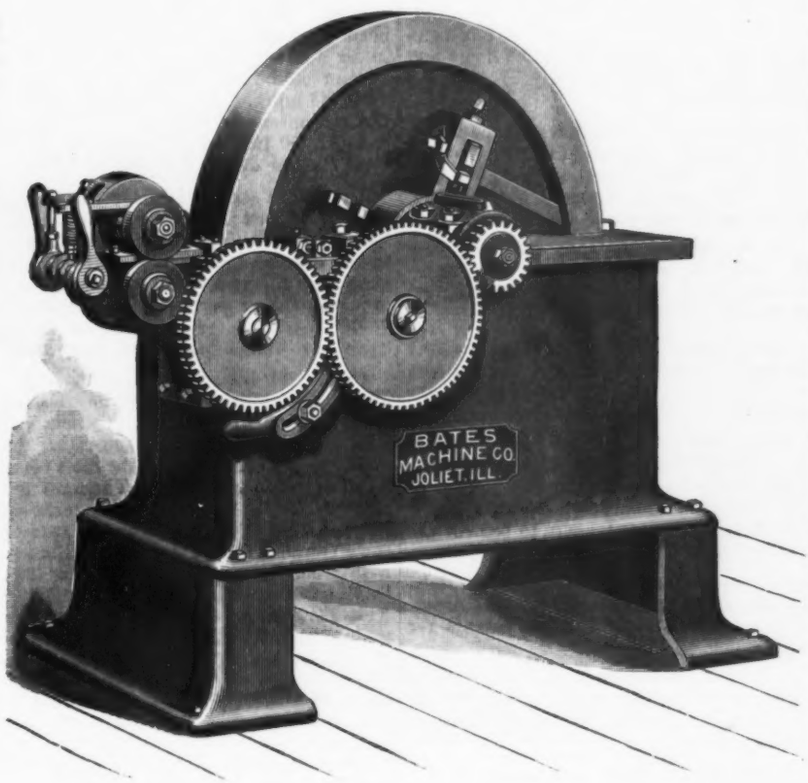
The Pillsbury-Washburn Milling Company, of Minneapolis, Minn., have just paid a dividend to their employees of the year's profits, in accordance with the practice of the Pillsbury Company, which was the first prominent company in the country to adopt the policy. The company refuse to name the amount of the dividend, but it is very satisfactory to the employees. It covers a period of ten months, as the new company assumed control of the mills November 1, and the dividend was made on the business done up to September 1. The men were greatly surprised when they found the check accompanying their wages, as they were induced to think the new company might not continue the practice. The dividend goes only to those who have worked for the company two years, and is based on the salary received.

Capt. Alex. McDougall, of Duluth, left for the East to purchase $150,000 worth of additional machinery for the new shops of the Steel Barge Company.

According to the latest report of the International Bureau of Telegraph Administrations, the submarine telegraph system of the world consists of 120,070 nautical miles of cable. Government administrations own 12,524 miles, while 107,546 are the property of private companies. The total cost of these cables is in the neighborhood of $200,000,000. The largest owner of these submarine cables is the Eastern Telegraph Company, whose system covers the ground from England to India, and comprises 21,860 miles of cable. The Eastern extension, which exploits the far East, has 12,958 miles more. Early in last year the system of West African cables, which started from Cadiz only six years ago, was completed to Cape Town, so that the Dark Continent is now completely encircled by submarine telegraph, touching at numerous points along the coast.

Staple Machine.

The accompanying illustration represents the new Staple Machine, manufactured by the Bates Machine Company, Joliet, Ill. It is unusually heavy and well built throughout, weighing as represented, 2600 pounds, and occupies a floor space of 26 x 46 inches. It is simple in construction, easily adjusted, and withal, they claim, the most successful machine ever put on the market. It has two cutters on each side and makes four staples at each revolution, cutting from two wires. Each wire can be cut independently of the other, and either wire started or stopped while the other is in motion. It is fitted with tight and loose pulleys 16 inches in diameter, 4 inch face, and should make 350 to 400 turns, thereby producing 1400 to 1600 staples per minute. During a recent test, 60 kegs of staples from No. 9 wire were cut in ten hours. The machine has been well and widely received.



STAPLE MACHINE.

Cable Road Construction.

Some very interesting facts are published in connection with the recent opening of the West Side cable roads in Chicago. The United States Construction Company, the corporation organized to cable the West Side for the West Chicago Street Railway Company, gave the entire contract for cabling West Madison street and the loop on the West and South Sides to E. D. Smith & Son, the cable contractors, of Philadelphia, Baltimore and Chicago. This firm completed the work without outside assistance, with the help only of their own men and plant, and now point to the finest construction of its kind in the country as an evidence of their capability. Work was commenced a year and a half ago, when it was expected the job would be finished in six months. It had been determined to use 6-inch rails, they being 1½ inches larger than those ever employed before. To make these the Johnson Rail Works, of Johnstown, Pa., was obliged to construct special rolls. Four sets of rolls broke before one was finished. This was the first delay. Then, when everything was ready, providence interfered and the Johnstown flood came to effectually bar progress. So it transpired that only 1200 feet had been prepared for the cable prior to last spring, thus giving the company the magnificent record of over ten miles of completed construction in less than six months.

This speed is remarkable, considering the difficulties to be overcome. West Madison street is a network of pipes, tubes and wires under its surface, and the work of excavation was often seriously delayed. At several points on the route extensive excavations walled in with masonry were necessary. The vault of this character at Jefferson street was a particularly difficult piece of work. Another cause, if not of delay at least of inconvenience, was the fact that after it had been resolved to have the loop on State street, and work had been carried on to this end, including the placing in position of intricate curves, frogs and switches, it was resolved to use LaSalle street instead of State street. This necessitated changing the North Side cable track on LaSalle street, from the entrance of the tunnel to Madison street, from the center to the eastern side of the street, to allow room for cars to run on the West Side loop. After E. D. Smith & Son had changed the North Side track, it was necessary to string the North Side loop cable so as to have it run through the new conduit. Everybody said this would take two or three days. E. E. Smith, the resident member of the firm, staked his reputation on its being done in one night, and done it was. It took 500 or 600 men and half a dozen horses, to be sure, but the work was finished on time and that was the point of importance. This was one of the most notable achievements of the entire campaign, and well illustrates the energy and perseverence of the contractors.

The speed with which the work of cabling Madison street progressed, when a fair start was made, is shown in work now in hand on Clybourn avenue, for the cabling of which street E. D. Smith & Son have the contract. Two and a half miles of cable construction have been completed on that street in four weeks. This is speed, indeed, when difficulties are taken into consideration.

The work of cabling a street is proceeded with as follows: Preliminary survey, laying of temporary side tracks, tearing up paving material, excavating, laying of concrete foundation at the point where each "yoke" or cast iron support is to rest, putting in yokes, riveting tubings, forming the conduit and extending from yoke to yoke, placing slot rails in position, putting in track rails, lining and servicing up the entire structure, placing concrete about the tubing, putting surface iron work in position, paving, after both tracks are completed placing drainage pipes between the two, and finally, stringing telephone wires, with alarm buttons at each manhole. Then comes the stringing of the cable, when, in the case of the West Madison street line, a specially constructed grip car, drawn by 48 horses, in five hours pulled the cable through the conduit and stretched it on the sheaves ready for the mighty engines to put in motion. The telephone, for use in case of accident, is an especially valuable appliance. It is connected at each manhole, and in particular, at the far side of each street crossing, with a push button. Every conductor carries a key which unlocks the manhole cover, and in case of an accident can notify the engineer at the power house in less time than it takes to tell it. This description, while sufficiently complete for ordinary purposes, by no means covers the infinity of operations incidental to the work.

The contracting firm surpassed all previous efforts in this great undertaking. On West Madison street the most powerful cable road engines in the world draw a cable that is attached to cars that travel over the heaviest rails used anywhere for the purpose. The slot rails are 9 inches wide, instead of 6 inches, as in all former construction. The tubing forming the conduit is of $\frac{3}{16}$-inch tank steel dipped in boiling pitch until coated and tempered by the immersion, and surrounded by 6 inches of concrete. No other company uses steel, and few employ concrete to surround even their iron tubing, and in some instances no tubing is employed, the conduit being formed solely of concrete. For this work on the Madison street line, an improved concrete mixer, designed by E. E. Smith, of the firm, was used. This has a 16 inch worm, instead of one 12 inches in diameter, as heretofore used. This machine can be drawn anywhere by a single pair of horses. The importance of concrete in connection with steel tubing is found in the fact that the steel will last from 25 to 30 years, after which the concrete will stand alone for an indefinite time. In Philadelphia an iron conduit, with no concrete, in place eight years, is still in good condition. Another improvement of great value is the double grip, taking up the cable on either side, instead of one side only, as in appliances used elsewhere. An idea of the magnitude of the work can be had from the amount of iron used. This, per mile is as follows: Cast iron, 323 tons; tubing, 127 tons; slot rails, 104 tons; track rails, 126 tons; bolts, 15 tons; total, 695 tons.

E. D. Smith & Son are not novices in their line. They have been building cable roads for eight or nine years, following being a partial list of roads, with mileage, constructed by them: In Philadelphia, Columbia avenue line, Old Market street line, Seventh and Ninth streets line, second Seventh and Ninth street lines, in all 25 miles. In Pittsburgh the Fifth avenue line, 10 miles long. On this road there has never been a serious accident. On its

course is a continuous double reverse curve ¼ mile long. Construction here was especially difficult on account of hills. The first cable lasted 13months before breaking. In Baltimore, 10 miles, of difficult construction, for the same reason that made the Pittsburgh lines. In Chicago, West Madison street, 10 miles; Clybourn avenue, 5½ miles; total, 15½ miles. On this latter line remarkable progress is being made. It will probably be open to the public by January 1. The total of mileage of road built by E. D. Smith & Son is, as is shown, over 60 miles.

THE WEEK.

The owners of the smelting works in Kansas which have been reducing Mexican silver lead ores have obtained titles to a tract of land at San Louis Potosi, and will erect a factory there on the largest scale.

The big railroad scheme, which was proposed several years ago by the New Jersey Terminal Railway Company, to establish a system of piers and basins along the New Jersey shore from Robbins Reef to Caven Point seems to be maturing.

The Standard Oil Company are unable to get their proposed big pipe line into Chicago. So the enterprise is blocked.

The Paterson Board of Trade are endeavoring to secure a navigable route to the sea by opening the old Dundee Canal, which has been a dormant project nearly 20 years.

The United Indurated Fiber Company, which is the lessee under some 50 patents, are bringing numerous suits in the United States Supreme Court for damages on account of alleged infringement.

A railroad bridge across the harbor at Bridgeport, Conn., is contemplated by the New York and New Haven Railroad Company. Valuable property has been purchased to secure the needed water front.

The New York Chamber of Commerce unites with the Mississippi River Commission in urging that the engineers expend the entire $2,000,000 appropriated by Congress for the improvement of navigation on the Mississippi and strengthening the levees.

The Grand Trunk Railway is proposing to build important branch lines with the object of recapturing the trade wrested from them by the Canadian Pacific since its invasion of Maine and the maritime provinces.

A machine in the Philadelphia post office can cancel and pile 25,000 postal cards and 15,000 letters an hour, with one attendant feeding at the hopper like trough and another removing and bundling.

Arthur Kirk & Son exhibit in Machinery Hall, Pittsburgh, a large working model to demonstrate the application of hydraulic pressure in operating locks, by lifting the gates vertically. By removing the pressure the gates sink by their own weight.

Western capitalists are planning for a railroad from Chicago to Mexico, through Des Moines. The leading incorporator is E. R. Hutchins, of Des Moines, and the proposed capital is $100,000,000. How to float the bonds is the puzzle.

The Western Union Telegraph Company made a profit last year of $7,312,725, an increase of $1,000,000 over the previous year.

A very large project has been formulated for the development of water power facilities at Rumford Falls, about 45 miles from Augusta, Maine. A main dam is now being constructed 427 feet long. There are to be four or five canals. According to an engineer's statement the total power of Rumford Falls, when fully developed as laid out by the plans, will about equal the total power at Lowell, Lawrence and Manchester combined.

The claim of the assignees of John Roach for indemnity was not approved by President Harrison.

Professor Thurston has begun at Cornell his course of lectures on the growth of the steam engine. The lectures are illustrated by the lantern, beginning with a description of the engine of Hero. Later he will take up the modern forms of the engine, beginning with that of Newcomer, showing the improvement of Watt and the work of later inventors as applied to the steam engine of to-day in its various uses.

The new Berkeley school building, to be finished next Spring, in West Forty-fourth street, will be absolutely fire proof. The entire framework is of iron construction, and the interior walls, the floors and the roofs are built entirely of iron and fire proof brick.

The exports of Alaska last year include whalebone, $1,000,000; salmon, $3,355,000; gold and fur seal, each $2,000,000. The total amount is nearly $10,000,000, or half the original cost of the purchase.

At St. Petersburg it is expected that the Siberian Railway, about to be commenced, will lead to closer commercial relations with the United States.

The Boston West End Street Railway Company have resolved to build an elevated structure with electricity for motive power.

The public lands are fast disappearing. The total acreage disposed of during the year, as shown by the Commissioners of the Land Office, is nearly 13,000,000 acres. The laws prove inadequate to protect the public forests from depredation.

It is announced that the Messrs. Colt, American makers, have bought the American rights to the Giffard gun patents for $1,000,000.

A line of steamers will run this winter between Tampa Bay, Florida, and Kingston, Jamaica, enabling Americans to reach the exposition.

It is reported New York capitalists interested in the Nicaragua canal will go to Greytown next month.

Colonel Gillespie has received authority to proceed with the removal of "Sunken Meadows," below Hell Gate, in the East River.

A Russian civil engineer, M. de Nicaloff, has succeeded in producing a fuel from peat greatly resembling anthracite coal. The artificial fuel throws off no dirt and emits no smell, while burning with a clear white flame.

The Egyptian cotton crop for the season of 1889–90 is the largest ever gathered, with a single exception, proving the excellence of the new irrigation system.

Sir John Pope Hennessy, formerly a Governor of English possessions in West Africa, and Edward Dicey criticise the plan of opening up Equatorial Africa by chartered companies. They favor the annexation policy, but doubt the profitableness of the trade that will grow up. Mr. Dicey thinks the mission of England is to found new dominions, open up fresh markets for British energy and capital, to people the globe with British settlements, and to rule subject races under the flag of the United Kingdom. But for Central Africa he urges inactivity, and to let Germany and France proceed in their work, when, after a time, England can step in and reap the advantage. England, with Zanzibar at the East and a highway through Egypt at the North, has already great advantages in the struggle for trade.

One of the disappointing features of protection in Germany is the increase in imports without a corresponding increase in exports. Mr. Wamer, the Consul at Cologne, states that much complaint has been made of the balance of trade against Germany in 1889. The value of the imports for the year amounted to 4,087,000,000 marks and the exports to 3,356,400,000, showing a deficit of 830,600,000 marks against Germany.

Another direct outlet from the Pennsylvania coal fields will be made by an extension of the Pennsylvania, Lehigh and Eastern Railroad from Tompickers to Port Jervis and the Poughkeepsie Bridge.

This year leads in the building record of Chicago. A close estimate for the closing months, added to what has already been accomplished, shows that 240,000 linear feet of new buildings will have been erected during 1890, or a frontage of about 45 miles. Averaging 25 feet to a house it means 10,000 houses, and at 20 feet 12,500 houses, or about 35 houses every secular day in the year.

The cotton seed and cotton oil trade of the season just closed is far from satisfactory, the outlets for oil not keeping pace with the increased production. An average of 37 gallons of crude oil to the ton, the total product is estimated at 740,000 barrels, of which the refined equivalent of 260 barrels was exported.

On the 8th inst. five steamships arrived almost simultaneously from Europe, bringing 4891 passengers, of whom only 3097 were in the steerage, indicating that about 25 per cent. were of the class recognized as summer tourists. The most notable of the fleet were the Teutonic and City of New York, which left Queenstown October 2, and arrived at this port within one hour of each other, the latter leading. On the last day's run the City of New York made 498 miles and the Teutonic 501 miles, in both cases the third day out from the port of departure. The official record of the City of New York shows that she logged 2775 knots in the remarkably quick time of 5 days, 21 hours and 19 minutes. Captain Irving of the Teutonic, reports that his ship logged 2779 knots in 5 days 22 hours and 19 minutes. The Teutonic, while she arrived one hour behind her rival, logged during the voyage 4 knots more than the City of New York. These achievements are at a cost in fuel to drive the engines equal to 350 tons of coal a day. But the play is worth the candle, according to the popular verdict

Engineer Fteley reports against the Quaker Bridge dam scheme for the increase of the aqueduct supply, as the proposed work would cost $4,000,000, and other sites less expensive are available.

The aggregate population of 34 of the largest cities in the United States is 10,234,000, which is 16 per cent. of the population of the whole country. In 1880 the same cities contained 7,072,000 inhabitants, or 13 per cent. of the population. So it would appear that about a quarter of the increase in the United States has been absorbed by the principal cities.

The Pullman Palace Car Company have obtained a decree in their favor in the United States Circuit Court, in Boston, Judge Colt presiding, which is claimed by that company to give them exclusive rights over the entire vestibule system. The main point at issue was the validity of the Sessions' patent, taken out by Mr. Sessions, manager of the Pullman Company, in November, 1887, two weeks before the

Pullman application was made. Judge Colt decides that Pullman's was the first invention and that Sessions can derive no benefit from the Pullman invention, because he nowhere describes or claims it in his patent.

Workmen will be surprised to learn from the proclamation of the Central Labor Union how much they have suffered: "Locked out men and women have been treated as outcasts and strikers as criminals. They have been denied the use of public streets; their houses and places of meeting have been invaded; their meetings dispersed; they have been clubbed and shot at without cause or provocation." These are serious charges.

The schoolship St. Mary's turns out this year 35 juvenile sea officers.

Chairman Walker of the "Gentleman's" Association has addressed a lengthy and interesting communication to the managers of the Western roads in which he comments upon the existing demoralized condition of Western railroad affairs, and suggests measures to bring about the necessary relief. He renews the suggestion that the entire Eastern traffic should be put in charge of a common agency. In other words, he believes that the several boards of directors should reassume the duties in this respect which they have allowed to drift into the hands of their general agents and rate clerks and by concurrent action should place the exercise of this important function in the administrative control of a small general rate committee, standing between the traffic departments of the roads on the one hand and the public on the other. Unless something of this kind is done, Mr. Walker predicts, railway managers will presently be chiefly receivers.

It is stated that contracts have been signed in Chicago for the construction of a 16 story "Fair" building for mercantile purposes to cost $3,000,000. When completed it will represent a value of $6,000,000, for the ground on which it will stand is leased at an annual rental of $154,000.

Steam was injected into the freight compartment of the Clyde steamship Iroquois, when she arrived at this port with her cargo of cotton on fire, and the vessel was saved from destruction. With pipes arranged for this purpose the danger from fire is reduced to a minimum.

The convention of the Brotherhood of Locomotive Engineers, at Pittsburgh, 16th inst., promises to be an interesting occasion. The programme includes addresses of welcome by Mayors Wymen, and Gourley on behalf of Allegheny and Pittsburgh, and by Governor Beaver on behalf of the State; addresses by Gov. James E. Campbell, of Ohio, Grand Chief P. M. Arthur, Hon. Chauncey M. Depew and other prominent railroad officials.

The recent advance in the prices of many articles of domestic consumption is ascribed by one of our commercial contemporaries almost wholly to the partial failure of certain crops, although it concedes that the Silver bill may have influenced the early advance in wheat. The editor says: "The quotations of hundreds of articles October 1, compared with similar quotations of the same articles a year ago, show an advance of 5 per cent. That is, the aggregate of all the articles, the quantities purchased being measurably proportioned to the actual consumption in this country, would have been $95.72½ this year, and $90.58½ in 1889, showing a rise of $4.59. Now, the fact is, that the advance in wheat, corn, oats, potatoes and apples, represents in the above reckoning a rise of $4,99½ in the aggregate cost, so that the aggregate cost of all other articles in the table was actually less this year than last." It is noticed, as being peculiar, that there seems to be a general tendency toward a lower level as respects a large proportion of manufactured products, despite the advance in wheat.

Proposed World's Fair Buildings.

Plans for the Chicago Columbian Exposition are now beginning to take shape. The Classification Committee have decided on the number and nature of the departments, leaving their final order an open matter until Professor Blake had had time to study the matter and suggest such changes as he might deem advisable. The system as adopted has 12 departments and is a radical change from Professor Goode's decimal system of classification. Under it there will be from 5 to 12 divisions to each department.

The report of the committee contained also suggestions as to buildings, and they are substantially as follows as regards size:

A—Agriculture—1200 feet long by 400 feet wide, with annex for power house.

B—Viticulture, horticulture and floriculture—To be built in the form of a cross, each of the four wings being 200 x 150 feet and the central rotunda 200 feet in diameter. An annex for heating boilers is also suggested for this building.

C—Live stock—No suggestion as to buildings.

D and E—Fish and fisheries, and mines, mining, &c.—600 x 150 feet, to include aquariums, &c.

F—Machinery—1750 x 500 feet. Two annexes are suggested for this, to contain boilers and working machine shop.

G—Transportation—600 x 650 feet, with tracks for the display of cars, motors, &c.

H—Electricity and Electrical Appliances—No estimate because of the size of the exhibits.

J—Manufactures—2000 x 600 feet, the building to be placed on an eminence that its proportions may be seen.

K—Fine Arts—No estimate.

L—Music, Education, &c.—700 x 350 feet.

M—Human Labor and Invention—Circular, 250 feet in diameter, to be erected by the Government, probably.

The dimensions of the buildings here suggested are on a scale of magnitude which shows how huge the fair is expected to be.

VIRGINIA IRON NOTES.

Mention was recently made in this correspondence of the organization of the Liberty Iron Company at Columbia Furnace. The new company have a capital stock of $500,000, and have acquired possession of 18,000 acres of mineral lands, including the Liberty and Columbia Furnaces. The first of these two plants is being torn down, and a more modern furnace is to be erected. These are very old plants, the Columbia having gone into blast in 1807, and the Liberty two years later. They are charcoal burners, and were in continuous blast up to 1887. The product of these furnaces has been noted among iron men for its superiority; as an illustration of the value placed upon it, 4000 tons of this pig has for eight years been held at Edinburg, Va., by the heirs of Mr. Wissler, the former owner of the furnaces. During the present year $27.50 has been offered for it, but the owners continue to hold it, believing they will yet get a better price. The new company intend building a railroad to Edinburg Station, on the Baltimore and Ohio Railroad, a distance of 12 miles. They also propose the construction of 20 brick charcoal kilns, each of 50 cords capacity. Other necessary buildings are in progress of erection.

A contract has been signed for the removal of the Duval Engine Company's works from Zanesville, Ohio, to Roanoke.

The final purchase of the Shenandoah Valley Railroad by the Norfolk and Western Company means a good deal for Roanoke. It is already announced by the authorities of that road that a number of new industries will be at once established in that city, and that the car wheel works will be enlarged to work 200 employees.

At Salem the Standard Iron Company, with $300,000, have been incorporated, with W. W. Brand as president, F. G. Webber, vice-president, and J. W. Talioferro as secretary, to work mineral lands in that vicinity and establish industries.

MANUFACTURING.

Iron and Steel.

Edge Hill Furnace, of the Crane Iron Company, at Edge Hill, Pa., has been blown out, for the purpose of relining and making other repairs. As soon as they are completed the furnace will resume operations.

The old Townsend Furnace, on the northwest corner of Elk and Hawk streets, Albany, N. Y., is being torn down, to make room for a new child's hospital building.

One of the blast furnaces of the Isabella Furnace Company, at Etna, Pa., was put in blast on May 26, 1886, and since that date has produced 270,000 gross tons of mill and foundry iron. The other stack of the firm was blown in on August 1, 1888, and has made 175,000 gross tons of Bessemer iron.

The employees of the Homestead Steel Works, of Carnegie, Phipps & Co., Limited, at Homestead, Pa., have organized a society for the advancement of technical knowledge among themselves. It is known as the Carnegie Polytechnic Society of Munhall.

The Laughlin Nail Company, with office at Wheeling, W. Va., and whose plant is located at Martin's Ferry, Ohio, have decided to go back to the use of coal as fuel, and expect to make the change about the first of the coming month. The reason given for taking this step is that the supply of natural gas is too uncertain to warrant the firm in continuing its use. The nail factory of this firm contains 192 nail machines, and has been in constant operation this year, and their product for 1890 will be considerable larger than for any previous year in their history.

It is announced that the Oliver Iron and Steel Company, of Pittsburgh, will take charge of the Iron City Bridge Works of C. J. Schultz, in that city, and fill all contracts that were on hand when Mr. Schultz made an assignment several weeks ago. The Oliver Iron and Steel Company are creditors of the concern in a large amount.

The plant of the Youngstown Bridge Company, at Youngstown, Ohio, is being operated double turn, giving employment to 115 men. The firm have received a contract for the erection of a bridge at Wheeling, W. Va., with a viaduct 750 feet long and four spans of 200 feet each. E. D. Cummings is superintending the work.

A company is being organized at McKeesport, Pa., to engage in the manufacture of iron safes; James Evans, W. C. Soles, T. D. Gardner and W. S. Chandon, of that city, are interested in the project.

The capacity of the rolling mill of the Portage Iron Company, Limited, at Duncansville, Blair County, Pa., has been enlarged by the addition of 17 more puddling furnaces and another train of rolls. The works now contain 37 single puddling furnaces, six heating furnaces and six trains of rolls. The nail plate train has been taken out and a 20-inch muck train and a 7-inch hoop train put in. The company are now prepared to make cotton ties, as well as bar, band, hoop, scroll and angle iron and steel. Cut nail making has been given up. The additions to the equipment of the mill increase its capacity from 8000 to 21,000 net tons of finished iron and steel annually. The officers of the company are now as follows: President, A. R. Whitney; vice-president, J. P. Meday; secretary, R. K. Hance; treasurer, D. A. Nesbitt, all at 17 Broadway, New York City. W. G. Merriman is general manager at Duncansville.

The two new blast furnaces of the Monongahela Furnace Company, at McKeesport, Pa., which have been in course of erection for the past year, are rapidly approaching completion. It is expected that Stack "A" will go in blast the latter part of November. The furnaces are very large and will have a combined output of 500 tons per day. William B. Schiller is general manager of the company.

The new blast furnace of the Isabella Furnace Company, at Ætna, Pa., will be put in blast some time during the present month. It is somewhat smaller than either of the two stacks now operated by this company and is

expected to turn out about 150 tons per day. It is fitted up with a new design of hot blast stove, the invention of Hugh Kennedy, the manager of the plant.

Rebecca Furnace, of the Kittanning Iron Company, Limited, of Kittanning, Pa., which has been undergoing repairs for some time, has again been put in blast. The output of the furnace, which amounts to about 125 tons per day, is converted into muck iron in the rolling mill of the above company and is sold to several Pittsburgh concerns.

The Falcon Iron and Nail Company, of Niles, Ohio, are about to build six new puddling furnaces at their Russia Mill. The company are now building three new ones in the Falcon Mill.

It is stated that a number of rolling mills at Wheeling, W. Va., are under contract to make muck bar during the greater part of the coming winter for Pittsburgh consumers, who are apprehensive of a shortage of gas in their own plants.

Riter & Conley, of Pittsburgh, have recently signed a contract with the Cumberland Gas and Iron Company, of Cumberland, Tenn., for the construction of a charcoal blast furnace to measure 13½ feet in the bosh and 60 feet high.

Creditors of the Glamorgan Iron Company, began proceedings in the Common Pleas Court on September 27, by which it will be attempted to hold the officers and directors of the company personally liable for the company's debts, amounting to $26,275.78.

The Cardiff Rolling Mill Company have been organized with a capital stock of $200,000 to manufacture sheet iron and sheet steel at Cardiff, Tenn. The works will include a puddle mill building 125 x 250 feet, to contain 12 puddling furnaces and one heating furnace with double train and squeezers, and a sheet mill building the same size to contain three trains of sheet rolls, with necessary annealing and heating furnaces. The capacity is to be 1500 tons of sheet iron and sheet steel per annum.

The Southern Iron Company, Chattanooga, Tenn., made their first shipment of steel on the 11th inst. to Portsmouth, Ohio. The company expect to continue to ship from 25 to 30 tons daily.

The Clinton Iron and Steel Company, of Pittsburgh, Pa., advise us that the report of the explosion at their blast furnace was much exaggerated. They were able to cast within six hours from the iron notch after the explosion, and the damage will be covered by about $2000.

The Rich Patch Iron Mining Company have been incorporated in West Virginia for the purpose of buying and selling mineral and timber land, to erect furnaces for the manufacture of iron and for buying and selling ores, coal and coke. The company are reported to have a paid up capital of $500,000, with the privilege of increasing to $1,000,000. The main office will be at White Sulphur Springs.

Machinery.

The Lake Erie Engineering Works are building a very complete machine shop at Buffalo, N. Y., at a total cost of about $300,000. The plans provide for a machine shop built on the gallery plan, 250 x 112 feet, and a foundry 230 x 112 feet, both shops to be ready for business by April 1. In the machine shop two 30-ton traveling cranes will be used, and in the foundry two 30-ton and two 6-ton traveling cranes, all operated by electricity. The shops will be supplied with the most powerful machinery, and will be capable of turning out the heaviest work.

The Minneapolis, Minn,, Threshing Machine Company will begin the manufacture of steam engines as soon as the necessary addition to their works can be built. The new plant will cost about $30,000, and give employment to some 125 men.

An organization has been formed at Cincinnati, Ohio, to build pipe works at Radford, Va., under the name of the Standard Pipe and Foundry Company. The amount of paid in capital is placed at $300,000, and the work of construction will begin at once. It is expected that the general foundry will be finished in January, and the pipe works by May 1. The capacity of the former will be about 25 tons per day, and the latter about 100 tons.

Thomas Carlin's Sons, founders and machinists, of Allegheny City, Pa., have sold the 44 x 36 inch engine that formerly run the rail train in the Union Mills, at Buffalo, N. Y., to the Republic Iron Works, at Pittsburgh. The 30 x 36 inch engine that formerly run the bar mill in the plant of the Columbus Steel Company, at Columbus, Ohio, has been sold to the recently organized Boston Iron and Steel Company, at McKeesport, Pa., and the 23-inch billet train, formerly used in the same plant, has been changed to a bar mill, and sold to the Lockhart Iron and Steel Company, at Pittsburgh. In addition to the above work, Thomas Carlin's Sons have recently sold a hoisting engine to the Moorhead-McCleane Company, at Pittsburgh, and have recently shipped a 22-inch engine, a pair of scrap shears and a pair of clipping shears to the Midway Iron Company, of Roanoke, Va.

The Lewis Foundry and Machine Company, Limited, of Pittsburgh, have just completed the shipment of an improved wire rod mill to the Kilmer Mfg. Company, at Newburg, N. Y.; also a 12-inch train for the Atkinson Car Spring Company, at Spaulding, Ill., and a 9-inch mill to the Illinois Steel Company, at Milwaukee, Wis. The company also report the receipt of a number of orders for their new hydraulic crane.

Fourteen of the 16 low pressure cylinders for the new cruisers No. 7 and 8 have been successfully cast at the Brooklyn Navy Yard.

The Navy Department of the United States has just awarded the contract to furnish the wood working machinery required in the navy yard at Norfolk, Va., to the Egan Company, of Cincinnati, Ohio Among the machines ordered is a complete outfit of planing, sash, door and blind machines. Preference was given to them on account of the late improvements, through which better and faster work is accomplished.

The Westinghouse Machine Company, of Pittsburgh, inform us that their sales of engines for the month of September amounted to 73 engines, with a combined horse-power of 4690. Among the sales we note the following: One 150 horse-power Standard for Russia; one 100 horse-power compound for Australia; one 150 horse-power compound for San Antonio Gas Company, San Antonio, Texas; one 125 horse-power Standard for Eagle Lock Company, Terryville, Conn.; two 200 horse-power compounds for Newark Electric Light Company, Newark, N. J.; one 80 horse-power compound for Albemarle Soap Stone Company, North Garden, Va.; two 100 horse-power Standards for Morris Machine Works, Baldwinsville, N. Y.; two 125 horse-power compounds for Newport News and Mississippi Valley Company, Newport News, Va.; one 125 horse-power and one 150 horse-power compound for East Tennessee, Virginia and Georgia Railway, Knoxville, Tenn.; one 150 horse-power compound for Edge Moor Bridge Works, Edge Moor, Del.; one 250 horse-power compound for Mount Morris Electric Light Company, New York; one 200 horse-power compound for Wm. Wood & Co., Philadelphia, Pa.; one 125 horse-power compound for Bay City Electric Light Company, Bay City, Mich.; one 125 horse-power Standard for Oliver & Roberts Wire Company, Pittsburgh, Pa.; one 125 horse-power Standard for Farr Alpaca Company, Holyoke, Mass.

Hardware.

On one turn, last week, the rod mill of the New Castle Steel Company, at New Castle, Pa., turned out 210,318 pounds of finished wire, which is the largest amount made by one turn in the history of the plant.

The Dubuque Brass and Metal Company, Dubuque, Iowa, manufacturers of brass goods for steam, gas, water and oil, with branch offices in Brooklyn, N. Y., New Orleans and San Francisco, are erecting buildings to accommodate their rapidly growing business. The main building will be 60 x 100, three stories high; foundry 40 x 100; pattern room 30 x 30, and coal room 30 x 40. The location is favorable for shipping, having an independent side track from each of the four trunk lines that run into the city, and is but two blocks from the Mississippi river. The latest improved machinery for their line will be put in, and a new system of melting brass used. They advise us their goods find a market in every State in the Union.

The Richmond Cedar Works, at Greenville, Ala., have taken off 24 iron pulleys from the arbors of their lead pencil grooving saws, and replaced them with the Menasha small hard maple pulleys, made by the Menasha Wood Split Pulley Company, of Menasha, Wis. This was done to stop the danger of heating the boxes, caused by the weight of the fast running iron pulleys on the arbors. The Menasha Company received orders last week for their hickory pulleys from John A. Cole, Rochester, Minn.; W. J. Clark & Co., Salem, Ohio; Alex. Ross, Sherbourne, N. Y.; Hayes Bros., Vincent, Ohio; J. P. Phillips, Toronto, Canada; Globe File Mfg. Company, Port Hope, Canada.

It is reported that a syndicate, composed of New Britain and Kensington parties, have bought the property of the Anglo-American Electric Light Company and intend building a large factory for the manufacture of glazed hardware paper, which, it is claimed, will be as good as the imported article. Some mineral ingredients necessary for its manufacture are said to be obtainable in the vicinity.

The Rockford Bolt Works, Rockford, Ill., advise us that they are at present very busy on special work, for which they have a growing demand in their own and adjoining towns.

The Terre Haute Shovel and Tool Company, capital stock $100,000, have been organized at Terre Haute, Ind. The object of the company is to manufacture and sell all varieties of agricultural and horticultural implements and tools.

Miscellaneous.

The Supply Mfg. Company, of Pittsburgh, have been granted a charter, with a capital stock of $50,000. The following are the directors: William J. Hammond, Robert R. Hammond, James H. Hammond and William E. Justin, all of Allegheny City.

The Kellogg Iron Works, of Buffalo, have secured the contract for the constructive and ornamental iron work to be used in rebuilding the Toronto University building, and have in hand similar work for the Practical School of Science at Toronto. Also for the industrial buildings at Mimico, Ont. All work required for the Dominion is manufactured at their Toronto shops, owing to the high protective duty.

There has been filed in the Secretary of State's office in the capitol at Albany, N. Y., a certificate of the consolidation of the Metropolitan Phonograph Company and the New York Phonograph Company, under the name of the New York Phonograph Company. The capital of the new company, which equals the aggregate amount of the two companies, is $2,500,000. The new company's trustees are: John P. Haines, of Tom's River, N. J., and John D. Cheever, R. T. Haines, Noah Davis, William Fahenstock, W. Seward Webb and John L. Martin, of New York City. The operations of the corporation will be carried on in the village of Tarrytown, town of Greenburg, Westchester County. Theas sets of each company will be inventoried, and all the property of the two companies, of whatever nature, shall become the property of the new corporation. The corporation paid a State tax of $3125 for the privilege of consolidation under the new name.

Among recently authorized corporations in Illinois are the following: Garden City Carriage Company, Chicago; to manufacture carriages; capital stock, $10,000. Incorporators, O. D. Sorang, Edmund C. Hayde, James A. Hayde. United States Spring Company, Chicago; to manufacture springs; capital stock, $50,000. Incorporators, C. S. Leed, Sam S. Hale, Charles N. Hale. Leadville Hollow Zinc Company, East St. Louis; to do general mining and smelting business; capital stock, $25,000. Incorporators, Daniel G. Taylor, L. Lewellyn, B. Dewitt, E. S. Roberts. S. H. Sinclair Company, Chicago; to manufacture laundry and other machinery; capital stock, $25,000. Incorporators, Frederick A. Walker, George Burry, C. C. Spencer. Freeport Implement Company, Freeport; to manufacture agricultural implements, machinery and vehicles; capital stock, $50,000. Incorporators, Walter G. Barnes, William Barnes, William H. Blosser, Jacob Kerch, Jr. Cordona Manufacturing Company, Chicago; to manufacture patented articles; capital stock, $25,000. Incorporators, Joseph Cordona, Carlotta Cordona, Theresa Hennessy. Locomotive Anti-Sand Equipment Company, Chicago; to manufacture railway appliances; capital stock, $50,000. Incorporators, Arnold J. Schevers, Thomas R. Freeman, Henry P. Reynolds. Turnbull Ventilator Company, at Chicago, to manufacture ventilators and ventilating apparatus; capital stock, $250,000. Incorporators, James J. McLaughlin, Charles A. Morgan and Albert G. Wheeler.

It is reported that Robert H. Shultis, who was the owner of a Kingston foundry and machine shop, which was destroyed by fire a year or so ago, is to accept an important position with the iron shipbuilders, Marvel & Co., and remove to Newburg, on the Hudson. Mr. Shultis is an expert in iron working.

Oliver Williams, president of the Eastern Bar Iron Conference, acknowledges the receipt of a large number of letters on the subject of classification, and informs us that he will reply to them when he returns from the Iron and Steel Institute excursion.

The Iron Age

New York, Thursday, October 16, 1890.

DAVID WILLIAMS, - - - PUBLISHER AND PROPRIETOR.
CHAS. KIRCHHOFF, JR. - EDITOR.
GEO. W. COPE. - - ASSOCIATE EDITOR, CHICAGO.
RICHARD R. WILLIAMS - - HARDWARE EDITOR.
JOHN S. KING. - - - - BUSINESS MANAGER.

Unprosperous Prosperity.

The condition of general business is attended with circumstances that are somewhat puzzling to a disinterested observer. Probably at no time in the past have the great business interests of the country experienced such a heavy draft on their resources as at present. The railroads report an unprecedented traffic. Iron and steel manufacturers have never before known such a heavy consumption of their various products. The building trades and all of the interests embraced in that category are driven with work. The demand for many classes of workingmen is in excess of the supply. Agricultural sections which have been depressed for years are rejoicing in a demand for their productions, which is rapidly absorbing the surplus carried over from previous seasons. Jobbers of all classes of goods have had a year of remarkable growth in the volume of trade. Here and there a special line of business suffers from a change in the wants of the people, and those interested take a naturally gloomy view of the situation, but they are almost lost to sight among the crowd whose products find favor. In the midst of all this turmoil of tremendous trade, it is remarkable that complaints are so numerous of a lack of profit in important branches of business.

Loud complaints, possibly the loudest, come from the railroads. Their lines are blocked with freight, and more traffic is being forced on them. Every available car has been brought into service, and still they are short of rolling stock to meet their requirements. The prospects are bright for a continuance of the rush of freight for months. Yet, with their facilities taxed and their opportunities for earnings expanded to the very maximum, the railroad managers generally assert that they are deriving very little profit from their operations. Net earnings are diminishing instead of increasing. Such low rates are now charged for moving freight that increased business means merely increased operating expenses and not greater net revenue. Dividend funds are decreasing, and gilt edge railroad securities are having the gilt badly tarnished.

Turning to the iron interests, we find the consumption of pig iron greater than ever before known in the history of the country. Stocks are not accumulating at the furnaces, showing that the demand is close on the heels of the supply. Bar iron has experienced a marvelous expansion of consumption, considering that but a short time since the outlook was strongly in favor of the early substitution of steel. The steel works have had a heavy year's business in supplying the requirements of their customers. Manufacturers of castings have been driven to their utmost capacity to supply their trade. Scarcely a foundry of any standing can be discovered that has not greatly increased its output this year. Even the stove foundries have been increased in numbers and enlarged in capacity to meet the wants of a growing trade. The jobbers of iron and steel wares have never known such a remarkable year for steady business as 1890 has shown itself to be. Despite all this there is a general complaint that margins are too close for comfort, and a complacent iron manufacturer or dealer is indeed a rare specimen.

The situation would not be at all peculiar if the apparent condition of prosperity were not so widespread. It does not merely appear in spots, but is general throughout the country. Competition appears to be excessive in every line. This seems to be the bane of existing business conditions. It is a mystery why a railroad company with every wheel turning that can be pressed into service should bid for more business by keeping its rates down or by lowering them still further. It is also a mystery why capitalists should engage in the iron trade when they see that existing works are barely able to make both ends meet, even when driven to their utmost capacity. It is a mystery why jobbers should cut their prices on staple goods to sell more hardware when they are not making a satisfactory profit on their regular trade. Combinations and consolidations do not cure these matters. Never before were combinations and understandings and agreements and special associations so numerous as now, but they have exerted a very limited influence. One circumstance that renders combinations peculiarly odious is the fact that it is not possible to make them general; hence those who are not benefited in that manner feel particularly aggrieved at those who are. It has been well said that we are always bitterly opposed to combinations that we are not in. But it would require a very remarkable aggregation of combinations and consolidations to make the condition of general business more profitable.

There are no remedies to propose for such a condition of things. It is a natural outgrowth of the increase of capital in this country, and will have to cure itself. The time seems to have come, which has often been predicted, when profits will be cut down to the lowest possible point consistent with the existence of an enterprise. The wealth of the United States and the rapid increase of workers qualified to fill the requirements of its varied interests have together brought about this change. When capital was wanting and men of special business training were scarce their profits were large, as competition was not keen. Those who invest in new enterprises now must recognize the changed situation and be prepared to be content with small profits.

In another part of this issue will be found a week's record of most remarkable work done by the Ashland Iron and Steel Company's charcoal blast furnace at Ashland, Wis. In this case a furnace only 60 x 12 feet has turned out 1009 tons of pig iron in seven days, using charcoal exclusively for fuel. M. R. Hunt, the efficient manager of this furnace, believes that he has beaten the record for a week's run of any other furnace of equal size in the world, whether using charcoal or coke, and we are inclined to think he is correct. Gogebic range ores were exclusively used, and Manager Hunt expresses the opinion that his large output is due primarily to that fact. These ores are found uniformly high in metallic iron, and contain other ingredients in such proportions as to give them the maximum amount of desirable smelting qualities. He believes that the Hinkle Furnace could not do the same work on any other ores. The statement we print is so complete that every charcoal furnaceman will be deeply interested in it.

Shrinkage of Speculative Securities.

The shrinkage in the value of Wall street securities attracts attention, the average being 20 to 25 points lower than last May, while many are lower than they have been for two years, and that notwithstanding railway earnings have been uniformly good. The prices of representative stocks as quoted now, in comparison with the beginning of the year, show extraordinary changes. A few of the granger and southwestern railway shares indicate a decline in market value of more than $70,000,000. The coal stocks show a decline of about $16,000,000, Lackawanna suffering least of all, and the Vanderbilts are down nearly the same amount. An examination of half a dozen specialties shows a decline in several instances, Chicago gas and cotton oil, for example, equal to at least $6,000,000 each. Altogether, as remarked by a prominent Wall street firm in their weekly review, the decrease which has taken place in fixed market values within a few months amounts to the enormous sum of about $150,000,000, and this despite the fact that meanwhile the stocks referred to have been subject to no exceptional influences. It is affirmed that liquidation has reached everything, and there is no certainty that the bottom has yet been touched. The causes ascribed are various and often contradictory, although it would appear that many who bought "long" in prospect of silver inflation and when the promise of large crops was more flattering than now, have become tired. It is felt, too, that financial conditions in England and on the Continent are not satisfactory, the discount rate of the Banks of England and of Germany having been recently advanced to a high per cent. as a protection from threatened stringency. Nor is it at once

apparent what has become of the enormous sums that have disappeared from European circulation. It is also intimated that Chairman Walker's recent letter, predicting bankruptcy if the railroads persist in their rate cutting policy, has something to do with the prevailing weakness. "Unless something is done," said Mr. Walker, "railroad managers will be chiefly receivers." On the other hand, grounds for assurance are found in the sound condition of the general trade of the country, which has long been conducted in a conservative spirit, and those persons best informed respecting the growth of the country and demands for transportation agree in representing that railroads have been extended only to correspond with legitimate needs, thereby keeping pace with the rapid development of material resources. In this last regard, however, there are some notable exceptions. It is a consoling reflection that "depression" is confined to Wall street. So far as this phenomenon results from scarcity of money, the situation is not necessarily an occasion for regret—extraordinary activity in business being the most obvious explanation of the condition of the market at all the leading commercial centers.

Employers' Liability Respecting Machinery.*

One who employs servants in and about the conduct of a business which requires the use of machinery thereby incurs certain attendant liabilities which arise out of what is known in law as the relation of master and servant. It is the primary duty of the master to furnish his servant with appliances so constructed that in the exercise of due care they may be used with reasonable safety, and they must be, and be kept without defects which will result in danger to those who use them properly. And a servant has the right to presume that the appliances furnished by his master are safe and sound and he is under no obligation to give them any more examination or inspection than the work required of him in connection with them involves. But it does not follow from this rule that the law requires the master to furnish such machinery as may be operated without danger to the servant under any circumstances, for in the nature of things this could not be so. There are many machines which when operated with the utmost care still result in subjecting the operator to a greater or less degree of danger, and whatever this danger may be, if it is unavoidedly connected with the proper operation of the machine, the servant is presumed to make his contract of employment with reference to that danger, and accept it as what is legally termed one the ordinary risks of the employment. The ordinary risks of employment, which are assumed by the servant and from which the master is relieved, may be in general terms said to be all those dangers incident to and necessarily arising out of the employment against which no protection can be afforded, in the exercise of ordinary prudence and foresight, without impairing the ordinary operation of the machine and infracting upon the ordinary duty of the servant. Having constantly in view the proper exercise of the duty of the servant to the master, it is incumbent upon the master to provide every safeguard which a prudent man would exercise, and the test in such a case as to what a prudent man would do is very often in law the common-sense proposition as to whether or not this master would himself undertake the work under the circumstances which he requires his servant to labor.

In addition to the ordinary risks of employment the servant assumes the danger arising from any defects in machinery of which he has notice. This notice may be either actual or constructive. That is, it may be knowledge which has come to him either from his own observation or from information furnished to him by or on behalf of the master, or it may be knowledge which he does not possess, but which he would have had, had he exercised his ordinary power of observation or made the ordinary inquiries which a prudent man under the circumstances would make. He is not charged with the duty of making a thorough investigation, for he has a right to assume that the appliances furnished him are not defective; but he is charged with notice of all defects which are so plain that the exercise of ordinary caution would notify him of them, and he is bound to take notice of irregularities in the operation of the machinery, not in themselves dangerous, but which might be caused by disarrangements which would naturally result in danger.

It is the duty of the master, in addition to furnishing safe appliances, to know that they remain in a safe condition, and defects which develop in the course of the operation of the machinery, unless they are of such a nature as to bring themselves to the notice of the servant operating it, will charge him with liability for resulting damages, even in the absence of actual notice to him. He is bound as well to keep his machinery safe as to make it safe.

While the rule charging masters with liabilities is broad and somewhat severe, it is founded in reason and equity and is seldom carried to an unjust extent. Where a servant is employed about a machine which presents no danger when properly operated, the fact that he is injured in its use raises a presumption that he did not exercise ordinary care, and the master is exonerated from liability (Zurn *vs.* Tetlow, 19 At. Rep., 504). The fact that where a servant is injured by falling, in an unusual manner and purely by accident, upon the knives of a machine, and where if the knives had been covered the accident would not have occurred, does not charge the master with liability when it is not shown that it is practical or usual to cover such knives, or that such consequences could reasonably be expected to follow from leaving them uncovered (Young *vs.* Burlington Wire Mattress Co., 44 N. W. Rep., 693). A foreman who orders a lad 14 years of age to oil and wipe gearing while the machine is in motion, without giving him careful instructions and full warning of the dangers, thereby subjects his employer to liability for any injury the lad may sustain, and it is a serious question whether or not one so young can be held to assume the risk incident to an undertaking involving so much danger (Neilon *vs.* Marinette & M. Paper Co., 44 N. W. Rep., 772). It is incumbent upon a servant who seeks to recover for injuries received by reason of defects in machinery to show that such defect caused the injury complained of and the specific nature of the defect alleged; and where the master alleges by way of defense that the servant had knowledge of the defect, he must prove it by a preponderance of evidence; and a finding by the jury that there is no evidence on which to base a finding on that point is, in law, equivalent to finding against the master and in favor of the servant (Sherman *vs* Menomonee Lumber Co., 45 N. W. Rep., 1079).

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Tne trade literature, inspired by the visit of the Iron and Steel Institute and the Verein Deutscher Eisenhüttenleute, forms a notable feature of the reception of the visitors at the leading iron and steel centers. Souvenir volumes have been prepared, describing local iron and steel interests and important manufacturing enterprises of a miscellaneous nature, which will form a valuable storehouse of information for our foreign guests. They will not only see for themselves the magnitude of our natual resources, but will thus be enabled to take back to Europe with them, in compact form, a vast deal of information which would require immense labor, if each individual was obliged to gather it for himself. Among these souvenir publications the volume issued by the Pittsburgh manufacturers is pre-eminently noteworthy. It is beautifully printed, illuminated with ornametal lettering in colors, and profusely illustrated, besides being gorgeously bound. Chicago makes a good showing, considering the comparatively recent origin of its manufacturing interests, and other cities have done very well. A collection of these volumes forms a little library of much interest and value to Americans as well as to our visitors.

It is unfortunate that iron and steel manufacturers are unable to take advantage of the general sentiment regarding the new Tariff act. The public seems to have been so well convinced that all duties are raised, that dealers in very many lines have been able to advance prices and to enforce the advance without difficulty, regardless of the facts. The new Tariff is the pretext for any kind of an upward movement. Some of the advances noted are utterly untenable, because the duties have been lowered and not raised on the goods, but as long as the public can be gulled "everything goes." Duties on iron and steel have been reduced quite considerably in many directions, but we have yet to hear of an advanced price being realized by iron and steel manufacturers and dealers "on

account of the new Tariff." They are either more honest than their fellow tradesmen or have less control over their business. This flurry over the new Tariff is a remarkable incident of the times, and shows how rapidly an idea can take hold of the people generally. The advances made on some goods are, of course, justified, but the widespread scare imposed upon buyers and consumers is not justified. The general publication of the new Tariff by the leading newspapers will, in time, correct this impression. If it does not, then a little judicious holding off by buyers will bring rapacious dealers to their senses.

Current Furnace Capacity.

The pig iron production of the country is again rising to close to the high figures of the spring, the increase being almost entirely due, however, to the activity among the coke furnaces.

As compared with previous months, the record stands as follows:

	Furnaces in blast.	Capacity per week. Gross tons.
October 1	336	179,263
September 1	323	171,776
August 1	324	164,798
July 1	336	175,727
June 1	345	180,791
May 1	344	180,099
April 1	344	178,474
March 1	343	180,991
February 1	334	173,651
January 1	333	174,038
December 1	328	169,151
November 1	323	165,225
October 1	311	151,057
September 1	294	134,068
August 1	286	145,899
July 1	285	141,419

On the 1st inst. the following anthracite furnaces were running:

Anthracite Furnaces, October 1.

Location of furnaces.	Total number of stacks.	Number in blast.	Capacity per week.	Number out of blast.	Capacity per week.
New York	23	7	2,589	16	4,095
New Jersey	14	6	2,937	8	2,855
Spiegel	3	3	223	0	0
Pennsylvania:					
Lehigh Valley	45	33	12,843	12	4,120
Spiegel	1	1	73	0	0
Schuylkill Valley	37	21	7,965	16	4,725
U. Susquehanna Valley	17	11	3,525	6	2,510
Lebanon Valley	16	9	3,910	7	3,006
L. Susquehanna Valley	17	8	4,257	9	2,215
Spiegel	1	1	325	0	0
Totals	174	100	38,627	74	23,526

For the past 16 months our records show the following:

	Furnaces in blast.	Capacity per week.
October 1	100	38,627
September 1	104	39,115
August 1	106	41,013
July 1	112	42,543
June 1	117	45,142
May 1	123	46,912
April 1	119	46,116
March 1	115	45,790
February 1, 1890	107	43,905
January 1, 1890	105	42,857
December 1	100	40,053
November 1	96	40,603
October 1	94	36,558
September 1	93	35,997
August 1	88	34,277
July 1	89	34,142

In New York Elmira has gone out of blast, while in the Schuylkill Valley No. 1 Phœnix was started early this month. There is nothing new in the Lehigh Valley, which is producing very close to full capacity. In the Upper Susquehanna Valley Red Point is out, while Marshall is running. In the Lower Susquehanna Vesta is out. In the Lebanon Valley the furnace of that name blew in on the 26th ult.

The status of the coke furnaces was as follows:

Coke Furnaces, October 1.

Location of furnaces.	Total number of stacks.	Number in blast.	Capacity per week.	Number out of blast.	Capacity per week.
New York	4	3	2,296	1	550
Pennsylvania:					
Pittsburgh district	21	18	25,803	3	2,914
Spiegel	2	2	1,792	0	0
Shenango Valley	19	16	11,447	3	2,353
Juniata and Conemaugh Valley	17	9	4,769	8	4,325
Spiegel	1	1	500	0	0
Youghiogheny Val	5	2	880	3	1,454
Miscellaneous	4	3	1,115	1	700
Maryland	5	2	3,640	3	3,830
West Virginia	6	3	2,558	3	770
Ohio:					
Mahoning Valley	14	12	9,313	2	1,410
Central and Northern	18	15	12,230	3	2,190
Hocking Valley	14	5	1,817	9	2,100
Hanging Rock	14	6	1,585	8	1,182
Indiana	2	1	237	1	210
Illinois	14	14	15,791	0	0
Wisconsin	4	4	3,135	0	0
Missouri	6	2	1,550	4	2,150
Colorado	2	1	450	1	430
The South:					
Virginia	12	11	5,931	1	250
Kentucky	4	3	830	1	310
Alabama	37	25	15,393	12	6,430
Tennessee	11	10	3,800	1	610
Georgia	2	1	310	1	460
North Carolina	1	1	125	0	0
Totals	239	170	127,247	69	34,628

As compared with previous months, the active coke furnaces make the following showing:

	Furnaces in blast.	Capacity per week.
October 1	170	127,247
September 1	156	119,757
August 1	150	113,040
July 1	163	120,673
June 1	167	123,340
May 1	169	122,489
April 1	173	121,560
March 1	169	122,595
February 1	169	118,568
January 1, 1890	169	119,396
December 1	162	116,319
November 1	160	112,269
October 1	154	102,454
September 1	141	96,744
August 1	137	96,720

In the Pittsburgh district two of the furnaces of Carnegie Bros. & Co. are producing spiegel and ferromanganese. The first stack of the Monongahela Furnace Company, at McKeesport, is rapidly approaching completion, and will go into blast in a short time. Rebecca is again running. In Ohio Steubenville has begun to produce, and the same is true of Belfont, Hamilton and Tropic in the Hanging Rock region. In the same district Wellston No. 1 resumed on October 1, after three weeks' repairs. In the Hocking Valley Crafts started on September 26. Girard Furnace has now the record of having since November 20, 1886, produced 208,761 gross tons on one lining, remaining in good condition still.

In the South Virginia has added to its current product through the blowing in of Princess and Pulaski. Gem, in the 12 months ending September 30, made 30,222 gross tons. In Alabama Lady Ensley has blown out, because the car supply for coke was inadequate. Fort Payne and one of the new De Bardeleben stacks blew in during September. In Tennessee every furnace, with the exception of one South Pittsburgh, was producing on October 1. Rising Fawn in Georgia is out.

The status of the charcoal furnaces was as follows:

Charcoal Furnaces, October 1.

Location of furnaces.	Total number of stacks.	Number in blast.	Capacity per week.	Number out of blast.	Capacity per week.
New England	14	6	520	8	570
New York	8	3	370	5	523
Pennsylvania	16	6	730	10	990
Maryland	6	3	258	3	240
Virginia	18	3	162	15	710
Ohio	11	7	584	4	170
Kentucky	1	1	108	0	0
Tennessee	6	4	1,005	2	130
Georgia	3	2	210	1	70
Alabama	14	8	1,860	6	1,510
Michigan	27	15	4,444	11	3,420
Missouri	2	2	625	0	0
Wisconsin	6	4	2,007	2	170
Texas	1	1	170	0	0
California	1	0	0	1	120
Washington	1	0	0	1	170
Oregon	1	1	336	0	0
Total	136	66	13,389	70	8,193

As compared with previous months the record stands as follows:

	Furnaces in blast.	Capacity per week.
October	66	13,389
September 1	63	12,904
August 1	59	10,745
July 1	61	12,511
June 1	61	12,312
May 1	52	10,098
April 1	52	10,804
March 1	59	12,606
February 1	58	11,378
January 1, 1890	59	11,485
December 1	66	12,779
November 1	67	12,893
October 1	63	12,047
September 1	60	11,327
August 1	61	11,902
July 1	60	10,727

In Pennsylvania Boiling Springs started on September 22. Muirkirk was added to the active list in Maryland. In Michigan Detroit Iron Furnace is out for repairs, but, on the other hand Eureka was added to the producers in September. Minneapolis started on the 7th ult. Hinkle lost 13 days accumulating charcoal, In Alabama Tecumseh was blown in on October 10, and Ironaton too is now running. Langdon stopped for want of material, but is to blow in soon.

A very fine sailing ship, said to be the largest in the world, was launched recently from David and William Henderson & Co.'s shipbuilding yard, at Meadowside, Partick, England. She is of steel, and will form an important acquisition to the mercantile fleet of France, in which country she is owned. Her dimensions are 360 feet long by 48 feet 9 inches broad and 30 feet deep. Her gross tonnage will be about 3750 tons, with a dead weight carrying capacity of 6159 tons.

In his will Benjamin Franklin bequeathed £1000 to the cities of Boston and Philadelphia, to be loaned at 5 per cent. to young mechanics. At the end of 100 years the cities and their States were to divide the amount, which was figured to be $665,000 for each trust fund. The 100 years have expired, and Franklin's heirs have commenced suit to recover the money alleging mismanagement on the part of the cities, Boston's fund having reached only $400,000 and Philadelphia's fund only $100,000.

The total number of cotton mills in the South is now 336, with 40,819 looms and 1,819,291 spindles. The increase of spindles during the past year is equivalent to nearly one-half of the entire number reported in the South by the census of 1880.

Washington News.

(*From Our Regular Correspondent.*)

WASHINGTON, D. C., October 15, 1890.

The recent issue of *The Iron Age* containing the elaborate series of drawings of the hull and machinery of the triple screw cruiser No. 12 has created quite a sensation among the naval authorities. The article, scientifically and artistically, was highly complimented and has called forth many appreciative remarks upon the enterprise displayed by the publication. It was remarked that *The Iron Age* in the spirit displayed in advocacy of the Government steps in promoting the manufacture of steel of the highest grades, the building of steel ships of the most advanced design and armaments of the highest power had already gone a long way toward establishing itself as the authority on iron and steel shipbuilding, as it has long been far in advance in the interests of all branches of the metallurgical industries and manufactures. The treatment of the subject of cruiser No. 12, which occupies the most advanced position yet reached by American naval experts, is characterized by those who are competent to express an opinion as far ahead of the technical journals.

Commodore Folger, Chief of the Bureau of Ordnance, Navy Department, says that the technical report on the recent test of plates will not be ready for ten days. The results, in a general way, he remarked, pointed in the direction of rendering obsolete all old methods. The English Campbell compound plate of the Wilson patent was knocked entirely out of the list of plates entitled to further consideration. The Creuzot (French) steel plate was also practically relegated to the rear. The behavior of the Creuzot nickel plate was all that was left worthy of consideration after the Annapolis firing.

Commodore Folger remarked: "Too much attention has been given to discussing the English and French steel plates. This is waste time. Their vulnerability to an 8-inch shot settles them. It does well enough to treat them as matters of ancient history in the matter of modern defensive armor for ships, but to treat them as live issues seems to be useless. All there was in the recent tests was the behavior of the nickel plates, therefore our investigations began and advanced from there. This was a new development and possibly a great stride in armor fabrication, I do not say that steel as a material for armor is obsolete, but the treatment tested most assuredly is. New methods of treatment may be discovered, and in that direction research and investigation will now tend. The newest field of scientific inquiry concerning the most approved armor plates is in the application of nickel."

The War Department is to have a boom in high power gun fabrication. The last Fortification act provides for 100 guns of large caliber and high power, and steps have been taken to proceed at once to their manufacture. The schedule of classes provides for 25 8-inch guns, 50 10-inch guns, 25 12-inch guns.

Before engaging for the entire number the Ordnance Department proposes to have the bidders first state a price for a type gun of each caliber and the ammunition for its test and the time when it can be presented for test. In the same connection the Department will require a price for the service guns each and ammunition for their proof. This contract will be subject to the behavior of the type guns under test. The Government is now thoroughly aroused on the subject of marine, fort and field ordnance. Great strides have already been made in this branch in naval circles where the urgency of the latest designs of ships demanded suitable armaments. The same progress may now be anticipated in the line of armaments for coast and harbor defenses.

The Board of United States General Appraisers are making a record for themselves. The weekly reports of reappraisements of value demonstrate one of two things, either that the old line of appraisers were very incompetent or dishonest, or that the complaints of undervaluation never half stated the facts, and that the appraisers are putting the screws upon foreign manufacturers and their methods of practically nullifying the tariff statutes. At New York, for instance, in reappraisement of value on an invoice of printed books they made an average advance of 131.9 and on three lots of Dutch metal leaf an average advance from 8.5 to 12.1 per cent. At Philadelphia on parts of clocks an average advance of 39.3 per cent.

A lot of basic steel rods was advanced in value from 122½ marks to 124 marks per 1000 kg. Iron cotton ties 2⅛ by No. 18 G by 11 feet, buckles threaded on and varnished, were advanced from £6. 11/8 per ton to £6. 14/2. It is evidently the determination of the board to break up the system of undervaluation.

Their reappraisements of value are numerous and afford an idea of the ruinous extent to which American manufacturers were undersold through the connivance of foreign manufacturers and importers. Why these schemes were not checked by the proper officials is the perplexing question to Treasury officials.

Progress of the South.

The past nine months have witnessed wonderful industrial activity throughout the Southern States. The *Manufacturers' Record*, of Baltimore, reports that up to October 1 there have been no less than 3172 new enterprises set on foot in the South. Of those relating to iron there were 47 furnaces, 108 machine shops and foundries, 13 agricultural implement factories, 4 stove foundries, 88 miscellaneous iron and steel works, rolling mills, pipe works and the like, besides 432 mining and quarrying enterprises. The prospects for the remaining quarter in this year are even more assuring than the three-quarters just ended. There are tangible evidences of new enterprises in every Southern State that will go to swell the list for the year to considerably enlarged proportions.

STEEL MAKING.

The steel making tests at the Southern Steel Works, in Chattanooga, Tenn., since the first trial have been equally as satisfactory and as successful as the run on the first day. A high grade of steel desirable for tool making was made from low grade white coke iron instead of charcoal after a heat of seven hours. The commonest material has produced a steel that Superintendent Talbot says is specially suited for flange boiler plate, and with this an undeniable fact, he says, his plant can compete with any manufacturer in the country. Mr. Talbot says that he makes a charge aggregating 50,000 pounds, 75 per cent. of which is scrap and 25 per cent. is ordinary Southern pig, against the usual charge made in Pittsburgh for extra fine flange steel of 14,000 pounds of superior pig, 25,000 pounds of muck bar, 6000 pounds of the best kind of plate scraps and 5000 pounds of wash metal. He thinks that the significance of this comparison can be easily seen. Continuing, Mr. Talbot said:

"In the first place the cost of producing the Pittsburgh steel is more than double that produced in Chattanooga, even though Pittsburgh has the advantage of natural gas. Take the one cost of muck bar alone; none is used in our furnace, hence we do not pay the extra charges for producing this material before using it in the baths of the furnace. Puddled iron before it can be used in an open hearth furnace costs at least $6 or $7 per ton; this then is saved on every ton of metal used. Then the pig, used in Chattanooga is very much cheaper than that used in Pittsburgh, because that used by us is a high phosphorus pig, which is always very much cheaper than a low phosphorus pig, which is always used in Pittsburgh; indeed, there is a difference of several doltars per ton. Besides these we make other savings which are not made in Pittsburgh, and this to my mind leads to the only possible conclusion that Chattanooga is destined to become a very dangerous rival to Pittsburgh. The cost of ore from the fields to the furnace and thence to the manufacturers is at least 30 per cent. cheaper in Chattanooga than in Pittsburgh, and in this one item alone Chattanooga more than rivals her competitor."

The Southern Steel Works use gas manfactured by the Martin-Siemens process. This plant is destined to do a great deal for the industries of Chattanooga. The first result of this industry which will stimulate trade is at the South Tredegar Company. This company once operated a nail mill which has been closed down for the past three years, thereby shutting out a large number of workmen. This mill is soon to resume operations, because it can now procure all the steel it needs from the Southern Steel Works, with whom, it is reliably stated, a contract has been closed for a continual supply. The South Tredegar will build 15 new puddling furnaces at once, and these will be constructed according to the most modern plans. They will have a capacity of 5 tons each per turn. When these are completed, the South Tredegar will have the largest capacity for turning out puddled iron of any plant in Chattanooga. The South Tredegar is in the midst of a busy season. They are crowded with business. Among the recent contracts is one with the Henderson Steel Works, of Birmingham, Ala., to supply the latter plant with iron scrap. Their Bessemer plant will, therefore, begin work at once.

HARDWARE MANUFACTURE.

The new plant at Fort Payne, Ala., of the Foster Mfg. Company will be under full headway by December, by which time about 500 men will be employed. The works cover 7 acres, the main building is a substantial structure of stone and brick, three stories high, and is fitted up with the most improved machinery. Near the main building are the blacksmith shops, foundries, brass works, carpenter shops, &c., making in all one of the most complete plants of its kind south of the Ohio River. General Manager Anderson states that the works will manufacture builders' hardware exclusively. Large orders have already been received, and the company expect to supply the Southern trade and eventually compete with Northern manufacturers in the Northern and Western States. Mr. Anderson, in explaining how they hope to compete with the Northern manufacturers in their own territory, says: "In the manufacture of builders' hardware the Northern manufactories are compelled to use a class of pig iron shipped from Scotland called 'Scotch pig,' while we find that we can use the iron made by the Fort Payne Furnace Company. In other words, our iron is right at our door, while theirs has to be brought a long distance." The Foster Company have an authorized capital of $400,000.

The value of platinum has risen to $14 per ounce, on account of the demand for electrical purposes.

TRADE REPORT.

Chicago.

(By Telegraph.)

Office of *The Iron Age*, 59 Dearborn street, CHICAGO, October 15, 1890.

Pig Iron.—The activity noticed in our last report continued through last week, and resulted in more sales than had been made during any one week for some time past. The principal demand was for Coke Iron, and lots ranging from 500 to 3000 tons were placed with parties who began negotiations about September 1. The inquiry for Charcoal Iron is light and prices consequently weak, sales having been made at figures below quotations of one month ago. Southern Foundry Irons have been in good request, with sales of round lots reported at a shade under recent asking prices. Mottled and Gray Forge have been sold at lower figures. One lot of 500 tons Mottled is reported at $13.75, and a similar amount of Gray Forge at $14.25. The makers of these Irons refuse to duplicate the sales. Upon the other hand, several sales of special brands of Southern Irons from 2000 to 3000 tons each, for delivery early next year, were made at about an average of $1 ℔ ton above present prices. The demand for No. 2 Soft is very good and the Iron exceedingly scarce. Consumers of all grades are demanding deliveries in advance of specified times, showing the market to be in good condition, with fair prospects that a decline in prices during this month is improbable. Shippers complain that railroad cars are very scarce, that it is almost impossible for them to meet the requirements of their consumers. Notwithstanding the delayed deliveries, the market is very active in shipments, and many of the makers of Iron are predicting higher prices. Some of the Southern furnacemen have added 25¢ ℔ ton to their price-list, but upon careful inquiry it would appear that they are well sold ahead for the balance of this year. Quotations are as follows, cash, f.o.b. Chicago: Lake Superior Charcoal, $19.50 @ $20; Local Coke Foundry, No. 1, $17; No. 2, $16; No. 3, $15; American Scotch, $18.50 @ $19; Southern Coke, No. 2, $15.75; No. 3, $15; Southern No. 1, Soft, $15.75; No. 2, Soft, $14.75; Southern Gray Forge, $14.75; Mottled, $14; Tennessee Charcoal, No. 1, $18.50; Alabama Car Wheel, $22.25 @ $23.50.

Bar Iron.—There is not much demand and no large buyers. Trade is largely confined to small lots from the consumers, with an occasional inquiry from jobbers. The latter are not disposed to buy unless they can shade the price sufficient to make it an inducement. Manufacturers are asking 1.90¢, Chicago, including half extras, but numerous quotations are reported at 1.85¢. The same price has been named flat for car specifications. One sale of mixed stock of over 1000 tons is reported at less than the latter figure. While the market is weak it does not appear that manufacturers are especially desirous of making sales. The condition of the Scrap Iron market makes these prices less profitable than manufacturers can afford to run their mills, and they are consequently withholding sales as much as possible, in the hope that better figures can be obtained later. The necessity for more cars is recognized by the railroads, but whether they will make the improvement this year remains to be seen.

Structural Iron.—The demand is fairly active for all grades, especially so on Beams, which continues much later than usual this season. The delay in the early pring, on account of labor troubles, delayed a great deal of work that is yet to be completed. Quotations, f.o b. Chicago, in carload lots, are as follows: Angles, 2.35¢ @ 2.40¢; Tees, 2.90¢ @ 3¢; Beams, 3.20¢; Universal Plates, 2.45¢ @ 2.55¢; Sheared Plates, Iron, 2.50¢ @ 2.60¢; Steel, 2.60¢ @ 2.70¢; Beams sell from store in small lots at 3.70¢, but Angles and Tees at 10¢ @ 15¢ ℔ 100 above carload prices.

Plates, &c.—There are no new features to note in this branch of trade. Deliveries are still delayed and mills unable to meet the demand on orders booked early in the season. There are no changes in quotations from store or mill.

Sheets.—There is no change in the condition of the Sheet Iron market. Mills continue to quote 3¢ @ 3.05¢ for No. 27 Common Black, and jobbers quote 3.40¢ on the same grade. Refined has advanced 60¢ ℔ 100, and is now quoted at 4.10¢. This grade of Iron is very scarce, which, in part, accounts for the large advance in price.

Galvanized Iron.—The demand is unabated. Prices have been advanced by jobbers. Juniata is quoted at 60 % and 5 % off from store.

Steel Rails and Fastenings.—The demand for small lots continues very fair. Prices are reported at $32 @ $32.50 for this year's delivery. There have been a good many inquiries for next year, but mills are not naming price. The prospect is that trade will continue quite active in furnishing supplies for finishing up repairs. The demand is scattered all over the Western territory, but the aggregate tonnage is not large. There is very little demand for Splice Bars, which are quoted at 2.10¢ @ 2.20¢ for Iron and 2.25¢ @ 2.30¢ for Steel. Spikes 2.20¢ @ 2.25¢ and Track Bolts with hexagon nuts, 3.10¢ @ 3.15¢ for future delivery.

Old Rails and Wheels.—The demand for Old Rails is improving. Several sales of round lots were made last week at figures ranging from $26.75 to $27.25. There is considerable demand that cannot be supplied, as railroads are holding stock which they have for higher figures; $26.50 is freely offered. No sales can be effected at less than $27 from present indications. Old Steel Rails, long lengths, are quoted at $22, and in fair request. Short pieces are not wanted and nominally quoted at $17.75. The market is well supplied with both grades. Old Car Wheels are unsaleable, nominal quotations being about $19. There are no buyers in the market.

Scrap Iron.—There is some improvement in the demand for Scrap. Dealers report firmer prices and stocks on hand rapidly diminishing. They are quoting selling prices per net ton as follows: No. 1 Railroad, $22 @ $23; No. 1 Forge, $21.50; Horseshoes, $21.

Detroit.

WILLIAM F. JARVIS & Co., Detroit, Mich., under date October 13, 1890, report the market as follows: It is impossible to note any change in the market since our last report. There certainly is a considerable volume of business and figures are fair, but not more. Southern Iron continues to be the weakest on the list, with prices quite as low as a week ago, and almost as low as at any time before in the history of the trade. In our local market Northern Coke Irons now cut but a slight figure; the quality of Southern Irons has so improved, together with better foundry practice, allowing a number of manufacturers to use Iron which heretofore they did not think it possible to do. Lake Superior Charcoal has shown several transactions of considerable magnitude. Prices have been firm, and the quantity on hand is decidedly small. Deliveries are being hurried forward by lake as fast as possible for this grade. We report the market to-day as follows:

Lake Superior Charcoal, all numbers	$20.50 @ $21.00
Lake Superior Coke, Bessemer	20 00 @ 20.50
Katahdin (Maine Charcoal)	24.00 @ 25.00
Lake Superior Coke Foundry, all ore	19.25 @ 20.75
Southern No. 1	16.50 @ 17.00
Southern Gray Forge	15.00 @ 15.25
Jackson County (Ohio) Silvery	19.00 @ 19.25

Philadelphia.

Office of *The Iron Age*, 220 South Fourth St., PHILADELPHIA, Pa., October 14, 1890.

Pig Iron.—The market shows an encouraging degree of steadiness, considering the enormous output, and all good Irons are readily taken at quoted rates. There is some slight approach to scarcity, but with the constantly increasing production consumers are not likely to be inconvenienced for want of material, hence prices remain steady, but without any special indication of an advance. The demand for low grade Irons is also very satisfactory, so that the entire market is in good shape, and in fact could hardly be better than it now is. Ordinarily we should be inclined to look for higher prices under such conditions as now prevail, but with new furnaces constantly springing up, the wonder is that the market holds as well as it does. On the other hand, it may be not out of place to inquire what sort of market would there have been if this extraordinary development of production had not been made during the past four or five years? In another column reference is made to four new furnaces which are to be blown in within the next few weeks, daily capacity 500 tons. A good portion of this Iron will probably be consumed in this vicinity, and if the demand keeps up to what it has been for the past two or three months, it ought not to affect prices unfavorably. But the trade have given up trying to forecast the future; they buy what they need to cover their contracts, and these needs, for several years past, have averaged pretty well up to the increased supply of Pig Iron. There has been no scarcity and no surplus, neither have prices varied more than $1 ℔ ton or thereabouts, and the conviction gains ground that the experience of the past four or five years will be the experience of a like period in the future—namely, an increasing consumption (with occasional set backs), but with no important variation in prices. Under this conviction the trade are not buying very far ahead, unless special inducements are offered them. Sellers have the same ideas, however, so that sales are at very uniform prices, the question of quality being the chief consideration. Latest transactions have been on the basis of $15 @ $15.50, delivered, for Gray Forge, $16.50 @ $17 for No. 2 Foundry and $18 @ $18.25 for No. 1. Outside lots are not offered to any extent, so that there is very little material offering at anything less than our inside figures. P. S.—Sales this afternoon of one lot of several hundred tons of No. 1 Foundry at $18.50, Philadelphia delivery.

Bessemer Pig.—Prices are more or less a matter of guess work, as new transactions are few and unimportant, and on terms which sellers decline to make public. The inference is that things are not altogether as favorable as could be desired, although those in the business profess to ridicule such prices at $18 at furnace. The chances are that consumers are not in the market to any extent even at $18, and if makers were under any necessity to realize, the figures named would be quite as high as they would be able to get. But there is no such necessity at present, neither are consumers under any necessity to place orders at higher fig-

ures, so that for the time being one offsets the other. A good deal of this Iron is being made, and it is all going into immediate consumption, but on what terms contracts will be renewed remains to be seen. Sellers intimate that the high cost of Ores is likely to prevent business at any such figures as buyers mention, but all the same, there is reason for the belief that good buyers would not have to wait long before offers of $18 @ $18.50 were accepted.

Spiegel and Ferromanganese.—Prices abroad have advanced about 5/ ℔ ton, leading to somewhat higher quotations on this side, but there is little or no demand. Asking prices, $31.50 for Spiegel 20 %, duty paid, and $70 for 80 % Ferromanganese.

Steel Billets.—There is considerable irregularity in this department, and it is not easy to give quotations with exactness. Latest sales of Billets are said to have been at about $32, delivered, but there are others quite willing to sell at $31.50; in some cases that figure could be shaded. Nail Slabs have been offered at $30.75, delivered, but $30.25 has been the best bid so far. Consumers are ready to place orders to a moderate extent, but they demand concessions. A few days more will probably determine which side will have to give way. The falling off in the demand for Rails is not a bull argument on Steel in the shape of Blooms or Billets.

Steel Rails.—There is a good deal of business offered, but not on terms that manufacturers care to accept. For strictly cash payments, $30.50 @ $31, at mill, is quoted, but on a good order $30 would probably be accepted. Small lots comprise the bulk of the business, and for the present mills have all the work they can handle. Winter work, however, would be taken on terms very favorable to the buyer, providing the security was satisfactory.

Muck Bars.—There is absolutely no change, except that a new candidate for business is in the market—viz., the Slatington Rolling Mill Company. But there are very few mills that have anything to offer until December, so that it is difficult to get Bars at less than $30.50, delivered. Buyers claim that $29.50 is all they can pay; but, all the same, it is noticed that anything offered at $30 is quickly taken, if of a good quality.

Bar Iron.—There is no scarcity of business in this department, the difficulty being rather to make deliveries as promptly as required. Mills are full of work, and as the current demand is fully equal to the output, little or no impression is made on back orders. This is a very satisfactory condition of affairs as regards manufacturers, and from present appearances is likely to continue for some time to come. Prices are, of course, very steady, varying a little according to quantity, delivery, &c., but 1.80¢, f.o.b cars at country mills, and 1.90¢, Philadelphia, are fair average rates for Best Refined Bars, and probably $\frac{1}{10}$¢ less for medium qualities.

Skelp Iron.—There is still a very good inquiry, and at slight concessions buyers would take hold quite freely. Makers quote about 2.05¢ @ 2.10¢, delivered, for Grooved, and 2.20¢ @ 2.25¢ for Sheared, but only moderate quantities are taken at inside figures, and these only to cover immediate requirements.

Plates.—The story of the past several weeks must be repeated again—viz., plenty of business, an urgent call for deliveries and firm prices. There are really no new features, as the demand is of a general character, and for every kind and every quality of Plates. Mills all busy, and for lots delivered in consumers' yards prices are about as follows:

	Iron.	Steel.
Ship Plates	2.25 @ 2.30¢	2.40 @ 2.50¢
Tank	2.25 @ 2.30¢	2.40 @ 2.50¢
Bridge Plate	2.30 @ 2.40¢	2.50 @ 2.60¢
Shell	2.45 @ 2.55¢	2.60 @ 2.70¢
Flange	3.10 @ 3.20¢	2.90 @ 3.00¢
Fire-Box	3.75¢	3.75 @ 4.25¢

Structural Material.—There are no new features in this department. Business continues very active, and manufacturers are pressed to the utmost to make deliveries. Prices firm as last quoted—viz., for lots in consumers' yards: Angles, 2.20¢ @ 2.30¢; Sheared Plates, 2.40¢ @ 2 50¢, and from 10¢ to 20¢ more for Steel, according to requirements. Tees, 2.7¢ @ 2.8¢; Beams and Channels, 3.1¢ for either Iron or Steel.

Sheet Iron.—Business is very active and mills are turning away orders daily because of the impossibility of meeting all demands that are made on them. Most of the capacity is engaged to the end of the year, without any indication of the demand being satisfied. Carload lots are quoted about as follows:

Best Refined, Nos. 14 to 20	3.00¢ @ 3.10¢
Best Refined, Nos. 21 to 24	3.20¢ @ 3.30¢
Best Refined, Nos. 25 to 26	3.40¢ @ 3.50¢
Best Refined, No. 27	3.50¢ @ 3.60¢
Best Refined, No. 28	3.60¢ @ 3.70¢
Common, ¼¢ less than the above.	
Best Soft Steel, Nos. 14 to 20	3¼¢ @ 3½¢
Best Soft Steel, Nos. 21 to 24	3⅜¢ @ 3¾¢
Best Soft Steel, Nos. 25 to 26	3¾¢ @ 3⅞¢
Best Soft Steel, Nos. 27 to 28	@ 4⅛¢
Best Bloom Sheets, 1-10¢ extra over the above prices.	
Best Bloom, Galvanized, discount	@ 60 %
Common, discount	62½ @ 65 %

Old Rails.—There is quite a good demand, but prices are not materially changed from last week. One or two lots have been sold within a day or two at $25.25 for seaboard deliveries, and others at $26 @ $26.25, at points in the interior. Offerings small and prices firm at figures above named.

Scrap Iron.—Demand improving, and prices firm at about the following quotations: No. 1 Railroad Scrap, $22.50 @ $23; No. 1 Wrought, $21 @ $21.50, Philadelphia, or for deliveries at mills in the interior $22 @ $22.50, according to quality and point for delivery; $15 @ $16 for No. 2 Light; $16 @ $17 for best Machinery Scrap, $15 @ $15.50 for ordinary, $15.50 @ $16.50 for Wrought Turnings, $11 @ $11.50 for Cast Borings, and nominally $26 to $28 for Old Fish Plates, and $17 @ $18 for Old Car Wheels.

Wrought Iron Pipe.—The demand is somewhat less urgent, but there is still plenty of business to be had, with fair prospects for its continuance to the close of the season. At the meeting of Pipe Association in Pittsburgh former discounts were reaffirmed, which are as follows: Butt-Welded Black, 47½ %; Butt-Welded Galvanized, 40 %; Lap-Welded Black, 60 %; Lap-Welded Galvanized, 47½ %; Boiler Tubes, 1¾ inches and smaller, 45 %; 2 inches and larger, 50 %; Oil Well Castings, 50 %.

F. R. Phillips, of Philadelphia, makes an important announcement in another part of this issue. Those contemplating the manufacture of Tin Plates will doubtless be glad to communicate with Mr. Phillips.

Edmund D. Smith & Co., 208 South Fourth street, Philadelphia, have been appointed exclusive sales agents for the Buena Vista Iron Company, of Buena Vista, Va.; the Salem Furnace Company, of Salem, Va.; the Graham Furnace Company, of Graham, Va., and the Max Meadows Iron Company, of Max Meadows, Va. These four entirely new furnaces have a combined daily capacity of 500 tons of Pig Iron. The Buena Vista and Graham furnaces will go in blast about November 1, to be followed in order by the Salem and Max Meadows furnaces. Edmund D. Smith & Co. are represented in New York and Boston by Messrs. George W. Stetson & Co., and in Pittsburgh by Messrs. F. F. Vandevort & Co., Limited. It is intended that the product shall be equal, if not superior, to any Pig Iron made in Virginia, and from the excellent character of their Ore deposits there is no reason why this should not be fully realized.

Chattanooga.

Office of *The Iron Age*, Carter and 9th Sts., CHATTANOOGA, October 13, 1890.

Pig Iron.—The tone of the market continues good. Prices are being fully maintained in accordance with the last report. The demand is very active, and includes nearly all grades. No. 1 is especially scarce, being with most furnaces sold into the future. The amount of freight that is coming into this country, as well as going out of it, is now simply enormous, and is taxing the railroads to their utmost capacity. They are still unable to promptly respond, and, cotton being rather the favorite, the consequence is that Pig Iron is somewhat the sufferer. This condition of affairs will probably extend through the entire year. Pipe Iron seems to be especially in demand. A few temporary strikes have caused some of the furnaces inconvenience, but at the present they have all been adjusted, and the output is about as usual.

Cincinnati.

(*By Telegraph.*)

Office of *The Iron Age*, Fourth and Main Sts., CINCINNATI, October 15, 1890.

Pig Iron.—The market in Cincinnati during the past week has been without special activity—that is, respecting new business, but the movement upon old orders has been quite heavy. Many deliveries upon previous contracts were much interfered with by the car famine, so stringent during September, but during the past few days a noted improvement has taken place in this respect, the railroads making heavy deliveries, especially in Ohio and the East. In fact, deliveries during the past week have been the largest within the history of the trade for a similar period. The largest Southern company have advanced prices 25¢ ℔ ton, but almost in the same time there have been some sales of moment at old figures, and some instances even at cut prices, where there has been an active competition. The demand has continued to be mainly for Forge Iron; there have been also fair orders for Foundry grades, while there is a very heavy melting of iron, and all industrial plants are overflowing with orders, many being several months behind in the filling of contracts. There are but few large concerns which have not provided for apparent needs up to the first of next year. There has also been a falling off in the number of small orders, indicating that the smaller works too have made some provision for the near future. But while there is less Iron selling, there is no anxiety on the part of producers to make sales, the most important Southern furnaces being sold liberally ahead. Other companies are preparing to follow the lead of the Tennessee Company in advancing prices. A point in favor of this move is the report of a decrease of 43,000 tons in stocks of Iron at furnace during the month of September. The recent low prices made on some Iron are regarded as having originated in speculative circles, and the gradual elimination of this speculative element places the market upon a firmer and more enduring foundation.

The outlook of the money market, however, is looked upon with some apprehension, which in connection with the development of unexpected weakness among some consumers of Pig Metal in the West has inserted an element of caution into the trade which will lead to a less active but a more stable business. During the past few days inquiries have been more urgent, and for larger amounts, aggregating upward of 15,000 tons. Actual sales, however, are not large, and without special significance. A few sales of moment have been made for delivery after the first of the year, among them being 2500 tons Mottled, on a basis of $10 at furnace, and 1500 tons Gray Forge on a basis of $10.50, cash, at furnace. We quote the prices current for cash, f.o.b. Cincinnati, as follows:

Foundry.

Southern Coke, No. 1	$15.25 @ $15.75
Southern Coke, No. 2	14.25 @ 14.50
Southern Coke, No. 3	13.75 @ 14.00
Ohio Soft Stone Coal, No. 1	17.00 @ 17.50
Ohio Soft Stone Coal, No. 2	16.00 @ 16.50
Mahoning and Shenango Valley	17.50 @ 18.00
Hanging Rock Charcoal, No. 1	21.00 @ 22.00
Hanging Rock Charcoal, No. 2	19.50 @ 20.50
Tennessee and Alabama Charcoal, No. 1	18.00 @ 19.00
Tennessee and Alabama Charcoal, No. 2	18.50 @ 19.50

Forge.

Gray Forge	13.25 @ 13.50
Mottled Neutral Coke	12.75 @ 13.00

Car Wheel and Malleable Irons.

Southern Car Wheel	22.50 @ 23.50
Hanging Rock, Cold Blast	22.00 @ 22.50
Lake Superior Car Wheel and Malleable	21.00 @ 22.00

St. Louis.

OFFICE OF *The Iron Age*, 214 N. Sixth st., ST. LOUIS, October 13, 1890.

Pig Iron.—Trade during the past week has been quite satisfactory. Orders for carloads and medium sized lots have been well up to the average. A scarcity of cars in the South is noticeable, which has hampered shipments, and this in conjunction with a steady demand has had the effect of advancing prices. There is a decided scarcity of Southern No. 1 and No. 2 Foundry; also No. 1 and No 2 Soft. Speculative lots of Iron on the market have had a tentency to weaken prices, but these stocks are now about closed out and their disturbing influence will no longer be felt. The Tennessee Iron and Coal Company have advanced prices 25¢ ℔ ton. For ordinary sized lots we quote as follows for cash, f. o. b. St. Louis

Southern Coke, No. 1 Foundry,	$15.75 @ $16.25
Southern Coke, No. 2 Foundry,	14.75 @ 15.25
Southern Coke, No. 3 Foundry,	14.25 @ 14.75
Gray Forge	13.75 @ 14.25
Southern Charcoal, No. 1 Foundry	17.50 @ 18.00
Southern Charcoal, No. 2 Foundry	17.00 @ 17.50
Missouri Charcoal, No. 1 Foundry	16.50 @ 17.00
Missouri Charcoal, No. 2 Foundry	16.00 @ 16.50
Ohio Softeners	18.00 @ 19.50

Bar Iron.—An active demand is reported from all points, and mills are kept busy making shipments, Prices are firmly adhered to, as follows: Lots from mill are quoted at 1.95¢. Lots from store command from 2.10¢ to 2.15¢.

Barb Wire.—There has been a decided increase in the volume of business during the week under review. Buyers have been holding off, waiting for lower prices, until their stocks have been depleted, and orders are now coming in very rapidly, more so than at any time since last spring. This state of affairs is also attributable to a certain extent to fair week, which has drawn hundreds of country merchants to the city. Prices are fairly well maintained, as follows: Painted, 2.90¢ @ 2.95¢; Galvanized, 60¢ additional. Carload lots, 10¢ ℔ cwt. additional.

Pittsburgh.

Office of *The Iron Age*, Hamilton Building, PITTSBURGH, October 14, 1890.

Pig Iron.—Business continues much the same as for some time past, demand being confined to supplying immediate wants, while prices remain unchanged. We continue to quote:

Neutral Gray Forge	$14.75 @	$15.25,	cash.
All Ore Mill	15.75 @	16.25,	"
White and Mottled	14.25 @	14.50,	"
No. 1 Foundry	17.00 @	17.50,	"
No. 2 Foundry	16.00 @	16.50,	"
No. 3 Foundry	15.50 @	15.75,	"
No. 2 Charcoal Foundry	21.50 @	22.50,	"
Cold Blast Charcoal	27.00 @	30.00,	"
Bessemer Iron	17.50 @	18.00,	"

In regard to Bessemer Pig it is evident that an effort is being made to bear the market. Sales have been reported at $17.50 and even $17.25, cash, whereas there are but very few sellers under $18, which may be regarded as the leading price in the absence of any actual sales. It may be that for immediate delivery some furnacemen in need of money might accept $17.75, cash, but we are assured by those in a position to know that even at $18 there is little or no margin for profit, and that the market in its present condition is not as satisfactory to the purchaser as it was at this time last year, when the price was from $2 to $2.50 ℔ ton less, as the cost of production has been greater. There has been very little demand of late for Bessemer, and there is evidently an effort being made to take advantage of the situation and bear the market.

Muck Bar.—There appears to be no abatement in demand, and prices are still drifting upward; during the week under review sales have been made for November and December at $31, and for immediate delivery at $31.25. Nearly all the mills making Muck to put on the market are oversold for the rest of the present year, and there are not very many buyers for delivery beyond January. Not for many years has there been such a profit for "converting" as at present; indeed, it is claimed by some that there is more money in making Muck for sale than there is in working it up into finished material.

Manganese—Continues quiet; occasional small sales of domestic 80 % for immediate or near by delivery at $72.50 @ $73.50.

Manufactured Iron.—There is a continued good demand, and prices are steady as quoted. Possibly there is not quite so much new business, but mills are all very busy on old contracts and are unable to catch up with the same. Common Bars, 1.85¢ @ 1.90¢; Refined do., 1.90¢ @ 1.95¢; Plate and Tank Iron, 2.20¢ @ 2.25¢; No. 24 Sheet, 2.85¢ @ 2.90¢; Skelp, 1.85¢ @ 1.90¢ for Grooved and 2.51¢ @ 2.20¢ for Sheared.

Nails.—The Cut Nail trade continues in an unsettled condition, and the prospect for improvement is not very encouraging. Steel Nails are still quoted at $1.85 @ $1.90, 60 days, 2 % off for cash. Jobbers are being supplied from other points, and some of our manufacturers are buying at Wheeling and bringing them here and jobbing them out to their trade. They say they can buy for less money than they can make them. Wheeling manufacturers admit that there is no money in Nails at present prices, $1.80 and less there, but they must keep their trade, and besides they are nearly all interested in Steel plants and make up on other specialties what they lose on Nails. A Wheeling manufacturer made the remark in Pittsburgh not very long ago that not a single keg of Nails had gone out of his factory at a profit for three years. Wire Nails are in very fair demand, but prices have further declined, and we now quote at $2.25 on cars at factory, 60 days, 2 % off for cash.

Wrought Iron Pipe.—There is not so much new business, but the mills are all very busy and will be for some time to come; they are being pressed on every side by those with whom they have contracts, and it is impossible to meet the wants of the latter as promptly as they would like; but it is probable that the rush will be over with this month. The regular monthly meeting of the association took place in this city last Wednesday, but, as wired to *The Iron Age* at the time, there was nothing done excepting to reaffirm former prices. The November meeting will be held in New York. Discounts as follows: Black Butt Weld, 47½ %; Galvanized ditto, 40 %; Black Lap Weld, 60 %; Galvanized ditto, 47½ %; Boiler Tubes, 1¼ inches and smaller, 45 %; 2-inch and larger, 50 %; Casing, all sizes, 50 %.

Old Rails.—No sales of Old Iron Rails reported recently, in the absence of which we continue to quote at $27.75 @ $28. There have been no buyers of late in this market, and it is said that valley consumers are pretty well supplied for the present. Old Steel Rails continue dull, and it is difficult to quote prices in the absence of sales; but there is no mistaking the fact that the drift for the time is downward.

Structural Iron.—Not so much new business possibly, but the mills are very busy working on former contracts, with which they are well supplied. No change in prices. Angles, 2.30¢; Beams and Channels, 3.10¢; Tees, 2.85¢; Steel Sheared Bridge Plates, 2.65¢ @ 2.70¢; Universal Mill Plates, Iron, 2.35¢; Refined Bars, 1.90¢ @ 1.95¢.

Steel Plates.—The Plate mills continue busy, and are working up to their full capacity. No change in prices. Fire Box, 4.25¢ @ 4.75¢; Flange, 3.10¢ @ 3.20¢; Shell, 2.90¢; Tank, 2.50¢ @ 2.55¢.

Merchant Steel.—Manufacturers report trade as being in a fairly active condition, with no recent change in prices. Tool Steel, 8¢ and upward; Crucible Machinery Steel, 4¼¢ @ 5¢; Open Hearth Steel base sizes, 2¾¢ @ 3¢; Bessemer Machinery Steel, 2.35¢ @ 2.40¢; Tire Steel, 2.50¢ @ 2.55¢ rates.

Billets and Slabs.—There has been very little new business of late, and while the market is generally considered weak, there has been no quotable change in prices for a couple of weeks. We continue to quote at $29 @ $29.50 on cars as makers' mill for Billets, and the same quotation will answer for Nail Slabs. It is rumored that a sale of Billets was made under $29, but was not well authenticated, and therefore not credited.

Wire Rods—Continue weak, and we again reduce our quotations, $41 @ $41.50, cash, at mill. There is not much inquiry, but offerings are small, as manufacturers here continue to use about all their own production.

Steel Rails—Continue dull and prices are week. We continue to quote at $30 @ $31, cash, on cars at works. There have been but few new orders placed here of late, but both of the mills are well sold ahead, and are in a very good condition in consequence, although both are anxious for more business. However, cost of production has been reduced but little of late, and so far as we know, $30 is bottom price, and then only for desirable orders.

Railway Track Supplies.—There is a fair demand, with prices unchanged. Spikes, $2.20, 30 days; Splice Bars, $1.95 @ $2.05 for Iron, and $2 @ $2.10 for Steel; Track Bolts, $2.90 with Square and $3 with Hexagon Nuts.

Old Material.—There is a steady demand for No. 1 Railroad Wrought, which may be quoted at $22.50 @ $23 ℔ net ton; Old Iron Axles, $28.50 @ $29; Cast Scrap, $15.50 @ $16, gross; Old Car Wheels, nominal, at $18 @ $18.50, but little demand here of late years; Bloom Ends dull at $20 @ $21. No sales reported of late.

Connellsville Coke.—The scarcity of cars continues, but it is probable they will be in better supply before long. Prices remain unchanged. Furnace Coke, $2.15, on cars at ovens; Foundry Coke, $2.45; Crushed, $2.65. Freight rates unchanged.

(By Telegraph.)

Nothing new in general Iron and Steel in additional to regular report; no abatement in the demand for finished material. One of our Merchant Iron firms reports orders on their books now that will keep them busy for 60 days to come. Very few if any of them in condition to book orders for immediate delivery. An increased demand for Iron is looked for soon, as consumers are low in stock and will have to replenish.

Charles E. Pope & Co., successors to Thomas G. Boyle & Co., at Pittsburgh, Pa., announce that they are prepared to fill orders promptly for Soft Sheet Steel, cut to sizes, Silica and Fire Clay Brick. The Pittsburgh office of the firm is in the Penn Building and the New York office is at 45 Broadway.

Lewis Bros. & Co., engineers and contractors, of Pittsburgh, announce that they are prepared to submit plans and furnish full information to those who propose to engage in the manufacture of Tin and Terne Plates.

Cleveland.

CLEVELAND, October 13, 1890.

Iron Ore.—The labor troubles at the Lake Superior mines have not thus far made their effect felt upon the receipts of Ore at lower lake ports, and vessels loaded almost to the water's edge are still arriving from Escanaba, Marquette and Ashland in a seemingly endless procession. The receipts of new Ore to date exceed 6,500,000 tons, an amount considerably over 600,000 tons in advance of the shipments at a corresponding period last year. It is, of course, reasonable to expect that navigation will close earlier this season than last, but that the Ore output will considerably exceed that of 1889 seems indisputable. The market is quiet, with prices very firm. There is a steady demand for both Bessemers and non-Bessemers, but as a rule the capacity of each mine has been fully sold up, and orders, except for a few hundred tons of some fancy Ore, cannot be filled. A strenuous effort has been made to force up lake freights, but without success. Vesselmen announce, however, that rates for next season will be 40 or 50 % above those now prevailing.

Pig Iron.—There is very little change in the situation. Soft Ohio Silvery is still in excellent demand at prices quite as firm as those prevailing last week. Forge and Mill Irons are in somewhat better favor, but the demand is not nearly as good as it should be when the energetic demand for other Irons is taken into consideration. It is said that concessions have been made in the selling prices for Bessemer Irons in order to effect immediate sales. To-day's quotations are:

Nos. 1 to 6 Lake Superior Charcoal	$20.00 @ $21.00
Nos. 1, 2 and 3 Bessemer, per ton.	17.80 @ 18.30
No. 1 Strong Foundry, per ton..	17.80 @ 18.30
No. 2 Strong Foundry, per ton..	16.80 @ 17.30
No. 1 American Scotch, per ton.	17.80 @ 18.30
No. 2 American Scotch, per ton.	16.80 @ 17.30
No. 1 Soft Silvery, per ton.....	18.00 @ 18.50
Mahoning and Shenango Valley Neutral Mill Irons, per ton....	15.00 @ 15.50
Mahoning and Shenango Valley Red Short Mills, per ton.....	15.50 @ 16.00

Manufactured Iron.—The market is still remarkably active, both Muck and Common Bar being in urgent demand. Sheets are scarce and valuable; Muck Bar at $30.50 @ $31 is selling as fast as it can be produced.

Old Rails.—Prices are less firm and a sale at $27.50 is reported, although quotations are announced as $27 @ $27.50.

Scrap.—Sales of No. 1 Railroad Wrought at $22.25 @ $22.50 are reported. Old Iron Axles are still worth $28; No. 1 Wrought Turnings, $14 @ $14.50; Old Car Wheels, $18, Machinery Cast, $13.

Nails.—Prices are unchanged, but the market is weak.

New York.

Office of *The Iron Age*, 66 and 68 Duane street, NEW YORK, October 15, 1890.

American Pig Iron.—The rather monotonous condition of affairs that has prevailed in this market for some considerable time past has been broken by the sale of a block of 1000 tons of Tennessee No. 1 Foundry—Lucy or Ensley brands—for October, November and December delivery, at $16.25 at tidewater. The lot was taken by a prominent local consumer. That this transaction, at so low a price, caused a little excitement among the local trade hardly need be stated, as it has all along been claimed that the particular brands specified, as well as several others popular with Eastern consumers, are in light supply. However, the facts are exactly as outlined above. The Iron sold was not No. 1 "Soft," as stated in some quarters, but strictly No. 1 Foundry, and the only extraordinary feature connected with the transaction is the very low price. It is the general report that no first-class Southern No. 1 Foundry can be had at less than $13 at furnace, or $17.25 at tidewater, for delivery during the balance of the year, and as much as $18 has been obtained for one brand where sold on terms easy for the buyer. Northern brands of high grade Foundry Pig have undergone no change, and the general situation is represented as being practically the same as for some time past, with very little accumulation of supplies in any quarter, and some inroads noted in the quantity of two certains brands lying at Perth Amboy. Low grade Foundry Pig is plentiful, as are also Mill grades, and prices for the same are barely steady. In most particulars the current movement is similar to what has been going on for some time past, and there are no signs of radical change in the general situation. We quote $17.50 @ $18 for No. 1 and $16 @ $16.50 for No. 2 Foundry, good Northern brands; $17 @ $17.50 for No. 1, $16 @ $16.50 for No. 2 and $14.75 @ $15.25 for No. 3 Southern.

Spiegeleisen and Ferromanganese.—There has been no change whatever in the condition of the market. Consumers manifest little more than passing interest in the offers making, and importers assert that the condition of the foreign market will not permit any concessions on former prices. Twenty per cent. Spiegeleisen is quoted at $30.50 @ $31 for German and $31 @ $31.50 for English, and 80 % Ferromanganese at $70 for future delivery.

Steel Rails.—Transactions in this market have been few and confined to unimportant lots. There are a number of inquiries, but they are chiefly of undesirable character, or for Rails for delivery next year, that agents do not appear inclined to take hold of at the present time. The basis of $30 at Eastern mills, this year's delivery, is openly quoted, and doubtless full value. The associated manufacturers have decided not to furnish for publication their monthly statement of sales and deliveries. A meeting of manufacturers will be held in this city on the 22d inst., at which the general situation will be discussed and probably some action taken in the direction of maintaining uniform prices during the coming year.

Steel Billets.—Prices in the Western Pennsylvania markets have dropped, and the Eastern markets are rather easier, as a matter of course.

Steel Wire Rods.—For Rods, prices have varied to no remarkable extent. Eastern mill rates are about $43 @ $43.50 for regular sizes. Special grades have brought as much as $45 in small quantities.

Structural Iron and Steel. — The situation in this branch is unchanged. New business is not on a remarkably large scale, yet enough comes up to keep the market in fairly good form and prices are steady. We quote at 2.25¢ for Universal Mill Plates, delivered; 2.10¢ @ 2.25¢ for Angles; 2.60¢ @ 2.70¢ for Tees, and 3.1¢ for Beams.

Old Rails.—Inquiries from the West are still on the market, but no important business has resulted, and buyers' and sellers' views are for the most part as far apart as they were a week ago. About 300 tons of foreign Tees were sold at $26, delivered at Philadelphia. A lot on the spot could have been secured at $25.50, in store, but buyers would not go above $25.50, f.o.b. cars.

Scrap Iron.—In Wrought Scrap there has been little doing. A small quantity went at $21, which price is 50¢ to $1 below holders' present ideas. A lot of 800 tons foreign, afloat, has been offered at $22, but was withdrawn on receipt of documents showing that the consignment included a considerable amount of Fish Plates. Car Wheels were offered at $18 here.

Warrant Stocks.—The American Pig Iron Storage Warrant Company report as follows:

	Tons.
Stock in yard, October 9	65,400
Put in yard seven days ending October 15	100
Total	65,500
Withdrawn seven days ending October 15	200
Net stock in yard, October 15	65,300

Metal Market.

Pig Tin.—There has been a steady downward movement in prices in both this and the foreign markets, with the outcome a decline of about 1¼¢ ℔ lb here and £2 ℔ ton in London. In the foreign market transactions in futures have been liberal the past few days, but local speculation has continued spiritless, and operators manifest a very cautious tendency. Some authorities assert that the decline is due in a good measure to manipulations, and that a larger portion of the supply received here has been distributed. It is obvious, however, that the local supply is ample for present wants. The short interest, apparently, is unimportant and afford little or no opportunity for a squeeze this month. Straits has been sold on the spot to the extent of 20 tons at 21¼¢ @ 21⅜¢ in 5-ton lots, and at 22¢ in smaller quantities, while sellers' option the balance of the month was offered at 21.15¢, and November and December at 21¼¢, net cash. Shipments from the Straits during the first half of October were 1250 tons to Great Britain and 275 tons to the Continent.

Pig Lead.—Domestic has been sold in carload lots at 5.90¢ and in smaller quantities at as high as 6.05¢, on the spot. Some sales were made at 5⅛¢ for deliveries a short time ahead, but sellers are not offering futures now except in a very cautious manner, and assert that supplies will be short up to the end of the year. There were moderate offers at 5⅛¢ November and 5⅛¢ December delivery. Foreign may be secured at 5⅛¢ @ 5.30¢ for November and December delivery, but no important quantities appear to be taken, and cable quotations reflect no unusual demand in the European market. About 150 tons went at 5⅛¢, early shipment.

Copper.—In this metal there has been little doing, and the general situation at the present time is practically the same as noted last week. The larger consumers, to all accounts, have their wants for the next ten weeks well cared for, and other buyers are taking no important quantities. Supplies are offered from first hands reservedly, but there is evidently more Copper available in one quarter or other than is needed at present, and prices are not remarkably firm. Lake Superior product is quoted at 16¼¢ @ 17¢. Arizona can be secured at 15½¢ and Common Casting Copper at 14¢ @ 14½¢, according to brand.

Spelter.—Transactions involving more than single carload lots have been very few and the demand has shown little spirit. The situation from the supply standpoint remains very strong, however, and prices are held at 5.90¢ @ 6¢ for prime Western brands.

Antimony.—Outside of the ordinary jobbing movement there has been little doing. Prices are barely steady at 18½¢ @ 19¢ for Hallet's and 21½¢ for Cookson's.

Tin Plate.—Business has been rather slow throughout the week. Some outside lots of Cokes went at irregular prices, but holders generally are firm in view of the strong position of the foreign market. Quotations for large lots on the spot are as follows: Coke Tins—Penlan grade, IC, 14 x 20, $5.50; J. B. grade, do., $5.50. Bessemer do., $5.50 Stamping Plates—Bessemer Steel, Coke finish, IC basis, $5.40; Siemens Steel, IC basis, $5.50; IX basis, $6.50. IC Charcoals—Calland grade, IX, ——; Melyn grade, $6.12½; for each additional X add $1.50; Allaway grade, $5.50; Grange grade, $5.85; for each additional X add $1. Charcoal Ternes—Worcester, 14 x 20, $5.50; 20 x 28, $11; M. F., 14 x 20, $8; do., 20 x 28, ——; Dean 14 x 20, $5½; do., 20 x 28, $10.25; D. R. D. grade, 14 x 20, $5; do., 20 x 28, $9.87½; Mansel, 14 x 20, $5.12½; do., 20 x 28, $10; Alyn, 14 x 20, $5.12½; do., 20 x 28, $10.25; Dyffryn, 14 x 20, ——; do., 20 x 28, $10.50; Wasters—S. T. P. grade, 14 x 20, $4.65; do., 20 x 28, $9.50; Abercarne grade, 14 x 20, $4.60; do., 20 x 28, $9.50.

New York Metal Exchange.

The following sales are reported:

MONDAY, October 13.

25 tons Tin, October.....21.50¢

TUESDAY, October 14.

10 tons Tin, October.....21.35¢
10 tons Tin, October.....21.25¢
10 tons Tin, December.....21.30¢

WEDNESDAY, October 15.

20 tons Tin, October.....21.30¢
10 tons Tin, December.....21.30¢

Coal Market.

The more confident feeling in the Anthracite Coal trade lately observed is unchanged, there being a good inquiry with large deliveries for former orders, restricted only by the cars available for transportation. Lack of cars is a source of complaint sometimes retarding shipments.

The Philadelphia and Reading Coal and Iron Company report their trade as being in good condition. Forty-five of their collieries are working steadily and are finding a ready market for their output. The three that are idle cannot be started at present, as one, the Buck Ridge, has been flooded to extinguish an inside fire, and the other two are undergoing extensive outside repairs and are having new inside workings opened.

The resolution adopted by operators a week ago to limit production to 3,500,000 tons is being adhered to so far as known, and it is likewise claimed that prices are maintained, that is to say, September prices, for it does not appear that any important sales have been made at the October advance. Quotations are: Stove, $4.30; Egg, $4.05; Chestnut, $3.95; Broken, $3.75; Pea, Free Burning, $2.60 @ $2.75, f.o.b. Both Pea and Buckwheat are more in demand and prices are stronger. The meeting to discuss prices was adjourned to October 18. The Philadelphia *Ledger* says: "Many of the anthracite operators report having already orders booked to take up the entire output of their collieries for this month, and some of them are declining to accept additional contracts excepting subject to any further advance in prices that may be made, to take effect next month." The official report of production for the week ending October 4 shows a total of 839,782 tons, and for the year 25,810,000 tons, a decrease of nearly 500,000 tons compared with 1889. The Pennsylvania Railroad reports 221,000 tons for the week and Reading 190,000 tons. The Reading is preparing to open new shipping docks at Perth Amboy, to be named "Port Reading." When 25 miles of road are built from Bound Brook and the new terminals finished the Coal shipping business will be removed from Port Liberty.

Bituminous Coal is reported more active and in more demand, partly on account of possible labor troubles. Cars are difficult to be had. Prices are firmer. Cumberland reports for the week 84,000 tons.

The Reading car shops are working extra time.

Important discoveries of Bituminous Coal are reported in Minnesota.

The Interstate Commerce Commission will begin an inquiry into the complaint of J. C. Haddock against the Delaware, Lackawanna and Western Railroad, in Philadelphia, on October 21. Mr. Haddock will endeavor to show that it is impossible for him as a miner of Coal to compete with the railroad, which is both a miner and carrier of coal; that while he may lose 25¢ a ton on every ton of coal produced, the railroad company will make $1 a ton for hauling the Coal, and can therefore afford to incur a small loss in its mining department. This is said to be the practice with every Anthracite carrying company. Rumors are current of an expected decision in the long pending case of Coxe Brothers.

Imports.

Hardware, Machinery, &c.

Barbour Bros. & Co., Mach'y, cs., 2
Boker, Hermann & Co., Arms, cs., 49
Field, Alfred & Co., Mdse., cs., 40; Anvils, 85
Folsom Arms Co., Mdse., cs., 15
Godfrey, C. J., Arms, cs., 4
Hartley & Graham, Mdse., cs., 23
King, Hezekiah, Mdse., case, 1
Lau, J. H. & Co., Arms, cs., 10
Meacham Arms Co., Mdse, cs., 13
Prosser, Thos. & Son, Mdse., cs., 91
Rotterdam S. S. Co., Arms, cs., 4
Remington Paper Co., Mach'y, pgs., 11
Ruppel & Co., Mach'y., case, 1
Schoverling, Daly & Gales, Mdse., cs., 12; Arms, cs., 11.
Werlemann, H., Arms, cs., 11
Wiebusch & Hilger, Mdse., 20
Witte, John G. & Bro., case, 1
Wyman, Chas. & Co., Mdse., cs., 21
Order—Mach'y, pgs., 18; Nails, kegs, 267

Financial.

The week opened with a circular from Secretary Windom, offering until further notice to redeem any of the $70,000,000 4½ % bonds with interest in full to maturity without rebate. The amount of these bonds outstanding October 1 was $69,826,000. This offer and the reasonable expectation that imports will fall off under the new tariff impart a feeling of increased security respecting the future of money. The loan market was moderately active, but firmer. The supply came chiefly from bankers' balances and from lenders who are not disposed to lend for definite periods. The demand for time money was good, but the supply was not liberal, and one feature was loaning by some of the foreign bankers on contracts arranged to mature in January, when a demand for money with which to pay duties on goods in bond, which must be withdrawn by February 1, is expected to be so urgent that renewals can be made at better rates. Nothing was done below 6 %. Banks generally took care of their regular customers of the mercantile class, but heavy demands for currency from country banks induced careful discrimination, more especially in view of the reduced bank reserves and the exceptional conditions now presented. The mysterious absorption of money recently noticed is remarked upon as follows: "No one would have deemed it possible that, within three weeks after the Treasury had suddenly distributed $60,000,000 of currency in special disbursements, the reserves of the New York banks should exhibit a surplus of only $3,000,000; and yet that very fact now faces us. The money has gone into circulation, comparatively little of it having reached this center, and yet the drain on this city has been and still remains extraordinary." On the other hand, it must be observed that money is already coming back from the South, and that the Treasury is paying out more money than it takes in; added to which there is to be an unlimited supply of money from the payment of $68,000,000 4½s from the circular of the 9th inst. Already the surplus at Washington is accumulating nearly or quite to $70,000,000. The weekly bank return showed a loss of $9,924,400 in cash and of $8,355,975 in surplus reserve, making that item $3,155,225.

The depressed condition of the Stock Exchange markets evokes free remark on the part of brokerage firms and bond speculators, who volunteer various explanations satisfactory neither to themselves nor the general public. Bear raids and disquieting rumors were the conspicuous feature. A certain degree of support came from the efforts of the trunk line presidents to advance rates of freight, and favorable results were expected from a meeting called for this week, but altogether there was a considerable liquidation of long stocks for home and foreign account. The selling of Sugar Trust was quite noticeable, and on Monday there was a break in Northern Pacific. The Villard stocks were influenced by the heavy loss in specie by the Imperial Bank of Germany. On Tuesday the downward movement was accelerated by heavy selling on London account and an expected advance in the Bank of England rate. The Clearing House Association decided the question of clearing for outside banks by adopting, with some modifications, the minority report submitted some time ago, which practically makes no change beyond the establishment of a fee to be paid by the outside bank. Exports for the week $16,000,000, a gain of upward of $7,000,000 over the previous week.

The decline in the price of silver is causing annoyance among the silver men.

It is less than two months since the Silver act went into effect, and only seven weeks since the Director of the Mint was paying $1.20¼ ₱ ounce, but since early September the price has steadily fallen. Meanwhile reports continue to be received of increased silver production, and the Treasury is likely to be flooded with silver for a long time to come. The champions of silver will undoubtedly renew the demand for free coinage with more agressiveness than ever at the coming session of Congress.

United States bonds are quoted as follows:

U. S. 4½s, 1891, registered	104¼
U. S. 4½s, 1891, coupon	104¼
U. S. 4s, 1907, registered	123¾
U. S. 4s, 1907, coupon	123⅞
U. S. currency 6s, 1895	113

British Iron and Metal Markets.

[*Special Cable Dispatch to The Iron Age.*]

LONDON, WEDNESDAY, October 15, 1890.

Operations in Pig Iron Warrants have been on a large scale, and prices have fluctuated considerably, dropping under the effect of realizations to 50/ for Scotch, 47/ for Cleveland and 57/4½ for Hematite. There has been considerable selling by holders who purchased quite freely a short time ago, in anticipation of strikes, and there is also some indication of reopening of "bear" accounts. The large decrease in stocks and damping of furnaces is greatly disturbing the Finished Iron and Steel trade. Steel Ship Plates are now quoted at £6. 15/, f.o.b. Barrow, but there has been no change on other Steel or Manufactured Iron prices. Warrants improved to-day to 50/6 for Scotch, 47/ for Cleveland and 58/ for Hematite.

Block Tin prices have gradually receded, going to £98 for prompts and £97 for three months' futures. Realizations by holders have relieved the stringency in available spot supplies, but the large consumption and reduced reserves, it is argued, are bound to strengthen the market again, unless heavy supplies arrive within the next fortnight.

Outside speculation in Copper has been very moderate, and prices for Merchant Bar prompts have dropped to £57. 5/. The bulk of the available supply remains in strong hands, however, and is firmly held. The trade demand continues large.

There has been heavy buying of Tin Plate for the 'Frisco market and prices have further advanced, with the demand still good, particularly on ordinary Cokes, for which 17/6 is now generally asked by makers. Buyers are still eager. Most makers having sold far ahead find orders for near delivery difficult to fill. Shipments have been very heavy the past week.

Scotch Pig Iron.—There is very little business, and the situation is still such that reliable prices cannot be quoted.

No. 1 Coltness,	f.o.b. Glasgow		Nominal.
No. 1 Summerlee,	"	"	
No. 1 Gartsherrie,	"	"	
No. 1 Langloan,	"	"	
No. 1 Carnbroe,	"	"	
No. 1 Shotts,	"	at Leith	
No. 1 Glengarnock,	"	Ardrossan	
No. 1 Dalmellington,	"	"	
No. 1 Eglinton,	"	"	

Steamer freights, Glasgow to New York, 2/, nominal; Liverpool to New York, 10/.

Cleveland Pig.—Business has been slow and prices are unsettled, with makers asking 49/ for No. 3 Middlesborough, f.o.b.

Bessemer Pig.—Prices are very irregular, but there is a good business. Makers quote West Coast brands, Nos. 1, 2 and 3, at 59/, f.o.b. shipping port.

Spiegeleisen.—The market remains firm and there is still a fairly active demand. English 20 % quoted at 102/6, f.o.b. shipping port.

Steel Rails.—Business is fair and prices remain steady. Heavy sections quoted at £5.2/6 and light sections £5.17/6 @ £6, f.o.b. at N. W. England shipping point.

Steel Blooms.—The demand is fair and prices show slight fluctuation. Makers quote at £4. 7/6 for 7 x 7, f.o.b. at N. W. England shipping point.

Steel Billets.—Demand has been moderately active and prices remain firm. Bessemer, 2½ x 2½ inches, £5, f.o.b. at N. W. England shipping point.

Steel Slabs.—There has been no change in prices. Demand is fair. Bessemer quoted at £5, f.o.b. at N. W. England shipping point.

Old Iron Rails.—There is a fairly active demand and prices remain steady. Tees quoted at £3. 2/6 @ £3. 5/ and Double Heads £3. 5/ @ £3. 10/, f.o.b.

Scrap Iron.—Business is fair at former prices. Heavy Wrought quoted at £2. 7/6, f.o.b.

Crop Ends.—The market remains unchanged. Bessemer quoted at £3. 2/6 @ £3. 5/, f.o.b.

Tin Plate.—Sellers are holding firmly at advanced prices, but the demand is less active. We quote f.o.b. Liverpool:

IC Charcoal, Alloway grade	18/ @ 18/3
IC Bessemer Steel, Coke finish	17/3 @ 17/6
IC Siemens " " "	17/6 @ 17/9
IC Coke, B. V. grade	17/ @ 17/3
Charcoal Terne, Dean grade	16/3 @ 16/6

Manufactured Iron.—There has been less doing in this line, but prices have undergone no change. We quote, f.o.b. Liverpool:

	£	s.	d.		£	s.	d.
Staff. Marked Bars				@	9	0	0
" Common "	7	2	6	@	7	7	6
Staff. Bl'k Sheet, singles	8	0	0	@	8	2	6
Welsh Bars (f.o.b. Wales)	6	7	6	@	6	10	0

Tin.—The market shows better tone today. Straits sold at £97. 10/, spot, and £96. 10/ @ £97. 10/ for three months futures.

Copper.—Demand is momentarily moderate and prices are irregular. Merchant Bars quoted at £57. 5/, spot, and £58 three months futures. Best Selected, £66.

Lead.—The market fairly active and firm. Quoted at £14. 7/6 @ £14. 10/ for Soft Spanish.

Spelter.—Prices have averaged somewhat lower on a moderate demand. Quoted at £24. 10/ for Ordinary Silesian.

A Chicago Jewish Training School.

The Jewish Training School, of Chicago, will open its doors October 20. The new building will be dedicated October 19. This building is situated in Judd street, between Clinton and Jefferson. It is of brick, four stories and a basement, and has been designed especially for the purpose of giving the poor children of the neigbborhood an education, in which it will be attempted to train their hands along with their minds. Between 800 and 1000 children have already enrolled their names as prospective pupils, and the registration is not yet over.

This school is a unique social institution, and promises to work a small revolution in the Jewish quarter of Chicago. Five or six years ago a number of ladies interested themselves in the education of Jewish girls in domestic economy, hoping thereby to influence the homes of the children—to teach the mothers through the daughters. A small school was started, and some 16 or 17 girls were taught the virtues of good cooking at an annual expense of between $1500 and $2000. This experience brought the ladies into contact with an enormous population which needed their civilizing influences. Mrs. Leon Mandel was one of the foremost workers in this field, and her husband promised $20,000 on condition that an equal sum be raised for the establishment of a school. The money was quickly raised, and two years ago the Jewish Training Society was formed. Property was at once purchased in the center of the Jewish colony, and the erection of the building was commenced. It is just reaching its completion. Mr. G. Bamberger was engaged to take charge of the institution. For the last 11 years he has been the head of a similar school in New York, established under the auspices of the United Relief Work Society for Ethical Culture. This school has never had more than 400 pupils, and the field in Chicago is much larger.

Mr. Bamberger has already gone to work. The number of pupils who have presented themselves is greatly in excess of the expectations of the founders of the school. About 80 per cent. of the pupils are the children of Russian Jews; 15 per cent. are from Polish parents; the other 5 per cent. are of German, Hungarian, or English parents. An inconsiderable number are French. Many of the parents and some of the children speak no language other than a composite jargon of Russian, Hebrew, and German, to which they are beginning to add English. This language has no grammar and no literature.

The school will be organized with three divisions, the kindergarten, the primary school and the grammar school. The course is 11 years, and it is proposed to add a high school next year that will increase the course to 14 years. Fourteen teachers have been engaged and three or four more will probably be employed. The primary schools will be taught by class teachers, but in the higher grade special branches will be taught by special instructors. In all classes, from the kindergarten up, manual training will be connected with the class work. No trade will be taught, but the rudiments of all trades, a knowledge of materials and the correct use of tools will be carefully instilled. For this purpose the building is thoroughly equipped with mechanical appliances, including wood and metal turning tools, worked by steam, a room for modeling in clay and plaster, a carpenter shop, &c. Geometry will be taught in connection with free-hand drawing. Chemistry and physics will be taught through work in the laboratory. The building also contains a gymnasium and an assembly room. Bathrooms form an important feature of the school. The institution is not sectarian in any respect, but will receive children of Christians as well as Hebrews. Tuition is entirely free.

The new ocean steamers to come out next season on the New York route are the Spree, from Bremen; the Prince Bismarck, from Hamburg, and the French steamer La Touraine.

HARDWARE.

Condition of Trade.

TRADE continues in good volume and with a confident feeling in regard to the future. From the reports which are given below it will be observed that in nearly all of the Hardware centers represented business is in a very satisfactory condition, being in many instances better than usual at this season. Prices on imported goods have generally been advanced in accordance with the provisions of the new tariff, and there is a disposition on the part of American manufacturers to advance their competing lines. There seems, indeed, to be a tendency toward advances in some directions where the increased cost does not justify them, and at the present time this disposition seems to give a certain strength to prices of many goods. It will be the part of wisdom for the trade to scrutinize closely announcements of advanced prices, as it is not unlikely that under this impulse certain advances may be made which will prove to be only temporary and nominal. In the following pages there are a number of changes in price, revisions of lists, advices in regard to consolidations, &c., which are deserving the attention of the trade.

Chicago.

(*By Telegraph.*)

The activity in the Hardware trade continues to be almost unprecedented. Jobbers are forced to utilize every available space in their immense house. Floor space for laying out goods is at a premium. Desks are shoved into corners and bookkeepers are compassed in smaller quarters. New goods are seldom shelved as they come in for want of time. Stocks are continually broken, and uncompleted orders are numerous and troublesome. Winter goods of every description are going out in large bulk. The demand for Cutlery is heavy and increasing. Shelf stock, such as Locks, Butts, Latches, Padlocks, Bolts and Sash Balances, are undiminished in demand, while the call for Tools, Stove Pipe, Coal Hods, Kitchen Utensils and heavy Hardware of all descriptions is increasing. Prices on Cutlery are advancing, on account of the increased tariff. Collections are good.

St. Louis.

The market has been unusually active during the past week. The City has been crowded with visitors, many of whom were Hardware merchants, and a majority of them left good sized orders behind. The demand from outside territory has also been large, and a comparison with last year's business shows a healthy increase. Builders' Hardware has had a large sale throughout the entire season. Wire Nails and Barb Wire are moving quite freely, and the demand for Shelf Hardware is well up to the average. Taking all things into consideration, the trade at large are well satisfied with the condition of trade, and are looking forward to a large fall and winter business.

San Francisco.

HUNTINGTON-HOPKINS COMPANY—Report business substantially as at their last advices, its volume being good and orders coming in freely, both from travelers and also from dealers direct. This condition of things is likely to last until the rainy season sets in. Collections continue good.

Portland, Ore.

FOSTER & ROBERTSON.—The volume of trade still continues good, each month showing a slight increase over the former one. Travelers' orders are about as they have been for the month past, while mail orders are somewhat better. The Exposition of the North Pacific Industrial Association, now in progress in this city, is bringing in an unusually large number of visitors, which has added somewhat to the trade for the last two weeks. Values are decidedly unsettled; at least on such goods as are affected by late tariff legislation, and in sympathy other goods not so affected are inclined to stiffen. Both importers and jobbers are completely at sea as to what price to ask, or whether it is best to sell at any price. Several sharp advances have been made in Solder, Pig Lead, Bar Lead and Shot, and there is a strong disposition to advance the price on Tin Plate, which is only held in check by ignorance of just what the advance is under the new tariff, and fear as to the effect of the unusually large importation now on the market and under way. Wostenholm Cutlery is very generally being held at an advance of from 10 to 20 per cent., while there is a disposition to decline orders for Wilson's Butcher Knives, unless at like advance. Without any united action on the part of jobbers, there has been a very general advance on Stamped and Pieced Tinware, prices now ranging about 10 per cent. above quotations of two weeks ago. Collections are opening in fine shape so far this month, and if present indications should be accepted there will be no financial stringency on the Pacific Coast this fall. A slight decline of 2 cents per bushel in the price of wheat, however, is very liable to give matters a complete turn, as farmers are evincing a strong determination to hold for recovery of prices, and some for even higher prices. This will have a natural effect of keeping the country merchant out of his money, and the jobber, in turn, will be called upon to carry the merchant.

Baltimore.

CARLIN & FULTON.—Trade is still fairly active, comparing favorably with the same season last year. We are pleased to note that remittances from the South are greatly improving, though we regret to hear of a greatly reduced cotton crop in southern Georgia, on account of the excessive rains, which may possibly affect collections in that section. Now that the Tariff bill has been signed prices will be adjusted accordingly, though the advances in many lines—notably so in the cutlery of Rodgers', Wolstenholm, Needham Bros'. brands, and in Belgian Guns—had been anticipated and announced some time before. The Nail market continues firm, and we have been advised of further advances in Shot, with a possibility of its still going higher. There are very few other changes to mention, and we suppose that business will continue on the even tenor of its way until toward the close of the year.

Cleveland.

THE W. BINGHAM COMPANY.—The general Hardware trade continues to be decidedly active. The travellers' orders show an assortment of goods that is quite satisfactory, and which denotes that the general trade among the retailers must be good. The demand for Tin Plates has been particularly large, notwithstanding the quite material advances. Nails are quoted at slightly better prices, Cut being sold from stock at $1.85, Wire $2.45, rates. Barbed Wire orders are fairly numerous at $2.95 for Painted, $3.45 for Galvanized. The outlook for the balance of the year is good. Money market still rather tight; collections fair,

St. Paul.

FARWELL, OZMUN, KIRK & Co.—Trade is fully up to the average for this season of the year, and collections show a considerable increase over last year. We look for a very satisfactory fall business. Seasonable goods are selling freely, with very little disposition to cut.

Philadelphia.

SUPPLEE HARDWARE COMPANY.—The state of the trade remains practically unchanged, and prices continue generally firm. The new list on Wostenholm Pocket Cutlery has been adopted, as has also the new list on Wostenholm, Worth and Butcher's Razors. The new list on Wilson and Worth Butcher Knives and Butcher Steels has gone into effect. Peter Wright's Anvils have advanced 1 cent per pound. Guns have advanced to conform to the change in the new Tariff law. Many kinds and makes of Pistols have not only advanced, but are very scarce. The new list on Halter Chains has been adopted. On domestic goods, Clothes Wringers have advanced in price. All kinds of Tinware has advanced, and there is a stiffening in the price of Eastern Carriage Bolts. Saws that have heretofore been sold at net prices have advanced, and the cheaper grade of Table Knives and Forks has advanced about 50 cents per gross. It is surprising to most of the trade that articles like Barb Wire, Cut and Wire Nails remain at the present low prices; especially is it surprising that Strap and T Hinges remain at the present low prices, taking into consideration the iron market. The increased production of iron is rapidly taken up. The trade will remember that during the scarcity of iron during the years of 1879 and 1880 it was then supposed that sufficient Pig Iron was produced to supply the demand, and it was only a speculative "corner," but when we

take into consideration that the production of Pig Iron in the year of 1879 was less than 4,000,000 tons, as against 10,000,000 at the present time, without any accumulation, the magnitude of the business is well shown, and with this showing it has no doubt prevented advanced prices, but the various uses to which iron is now adapted thus far prevents any great accumulation. Those who have carefully looked into the iron market were even themselves astounded when the assertion was made before the Iron and Steel Conference that the world would require 35,000,000 gross tons of iron in the year 1900, basing the increase on the natural increase of the country, together with the new uses to which iron would be applied. If these remarks are correct, we may naturally look for an increased scarcity of iron instead of an overproduction for the next few years to come. Improved devices and improved machinery have of course materially assisted in cheapening the prices of many kinds of goods which depend principally on raw material. Nevertheless, these goods are very low, without much profit to the manufacturer, and without a real appreciation of the facts of the case on the part of the consumer. Stocks in the hands of the jobber in this market continues fair. Only in certain kinds of goods is there a scarcity. It is necessary for the jobbers to watch their stocks of Hardware more carefully than heretofore, as the retail trade are not satisfied unless they have immediate shipment of their orders.

Louisville.

W. B. BELKNAP & Co.—Business has been somewhat affected by the wet weather south of us in the cotton belt, and by the very close money market near at home. Country and Southern banks have never made such drains upon their correspondents as this season. The national bank statement, just issued, shows a large amount of money under re-discount, much more than usual even at this season of the year. The large crops South and the increased volume of business have called for more money than in previous years, but this demand should not be unexpected or regretted; it should simply suggest to the capitalist that the South is a desirable field for lending his money. Bank rates for commercial paper are firm at 7 per cent., insiders with good collateral may get it at 6, while for small amounts and outside custom 8 per cent. is sometimes asked. We hardly look for much relief from this financial stringency till the cotton crop is sold and realized on. Meanwhile business is brisk and prices well maintained. The following peculiar features may be noticed in the market, namely, that base sizes of Common Bar Iron are selling as high as base sizes of Steel Nails, if not $1 a ton higher. Old Iron Rails are selling within $2 per ton of new Steel Rails. Muck Bar is about the same price as Steel Slabs. While Pig Iron is exceptionally weak, according to the statement of all brokers, and has next to no sale, Bar Iron is stronger, and there is a better demand for it than we have known for years. Sheet Iron is in somewhat more abundant supply, the mills having anticipated a rather heavier consumption than has taken place. Galvanized Sheet continues short. All metals are firm. Foreign Cutlery has been advanced as a result of the new Tariff bill.

Wire Nails.

THE VOLUME of business in this market during the past week has been moderate, but prices are without especial change on the basis of $2.40 at mill. The manufacturers are apparently more desirous than they have been to book orders, and the tone of the market is not quite so firm as it was a few weeks ago.

Chicago (*By Telegraph*).—The market practically recovered from the weakness noted a week ago. For a few days prices were shaded, but jobbers claim that they are not now sold at less than $2.55 in carloads, and $2.60 out of store. Manufacturers are asking $2.42½ to $2.45, Chicago, and few, if any, sales are made at less than this price. The demand is very good for this time of the year.

Cut Nails.

THERE has been no change in the New York market since our last report. The volume of business is not heavy, but the general tone of prices is good. A meeting of the Eastern manufacturers will be held on October 17 and their action is awaited with interest. It is a matter for congratulation that the prices established by them at their last meeting have been so regularly maintained. Quotations for Iron Nails are as follows: $1.80 at mill, $1.90 at dock, $2 from store. For Steel Nails 10 cents is to be added to the above figures.

Chicago. (*By Telegraph*).—Wheeling mills are asking $1.90, Chicago. Some jobbers quote $1.90 in small lots and 2 per cent. off in carload lots, and others $1.95 in any quantity.

Barb Wire.

THERE is in this market a somewhat improved demand, but the volume of business is not especially large. Prices are steadily maintained, with rather a firm tone. Quotations continue to be 3.30 cents, at mill, for Four Point Galvanized.

Chicago (*By Telegraph*).—The condition of the past month continues. Orders are for small lots, but there is not enough of them to make an active market. The prevailing price is 2.9 cents for Painted and 3.5 cents for Galvanized.

Export Trade.

THE value of exports from the port of New York, during the past week, reached the exceptionally large amount of $16,000,000.

The trade in Australia is interfered with very seriously by the strike which commenced with the marine officers, but has spread until all lines of business have been affected. The officers were followed by the Seamen's Union, Welsh laborers and longshoremen, and owing to coal having been supplied to vessels having non-union crews, the miners at New Castle and elsewhere struck, which has caused a great scarcity of coal. In Melbourne this has become so bad that most of the factories have been obliged to shut down, and the gas supply has been cut off except for use in dwellings, the stores, churches, places of amusement, &c., being obliged either to close or use other means of lighting Although Sydney has been more fortunate thus far, the prospects are that the supply of gas will be cut off and that most of the factories will be obliged to shut down owing to the scarcity of fuel.

The shipping interests were, of course, the first to suffer, and although a few vessels are being loaded and discharged by non-union men, the shipping accomodations are very limited. The importers at Sydney have been obliged to send their staff of clerks, salesmen and porters to unload cargoes consigned to them, and there is a report that union draymen will refuse to cart goods discharged in this way. So little trade is being done at this point that we are advised that several large houses have laid off a number of their employees, and other houses intimate that they will be obliged to do likewise unless the strike comes to an end soon. The stores are described as being deserted and the streets as having a holiday appearance, being filled with men lounging about who are usually hard at work. When this state of affairs is likely to end it is impossible to say.

In the South African markets heavy bank failures have made credits quite uncertain, and many of the commission houses in New York are holding orders for further developments.

The freight market continues as last reported. The steamship Karlsrule closed on the 8th. She is expected to reach the Australian market at about the same time as the first steamer that left, the Prodano, and she carries freight about 3 to 4 cents per cubic foot cheaper. In the Argentine Republic nothing is being done yet. Merchants here report that they cannot ship goods until a better state of affairs exists than at present.

South American and Mexican business is referred to in a general way as only fairly satisfactory, and there is some complaint in regard to the amount of trade.

Miscellaneous Prices.

THE MARKET for Rules is without material change, and low prices are still being made by the manufacturers. Stephens & Co. advise us that they have made a slight advance in the extreme prices quoted, but we cannot learn that other manufacturers have taken similar action. There is some difference in the prices given on Rules, according to the desirability or otherwise of the assortment ordered.

Tackle Blocks continue low and irregular. It is, however, reported that one manufacturer has withdrawn some of the extreme quotations which have previously been made.

There is a disposition on the part of manufacturers of Tinware to make advances, and some extreme quotations have

been called in. The market in this line may be referred to as slightly firmer, with a tendency toward better prices.

The manufacturers of Pocket Cutlery regard the situation since the passage of the revised Tariff bill as decidedly improved, and the market is in an improved condition, although few definite advances have been announced. It is probable that buyers of Cutlery on future orders will have to pay slightly better prices than have prevailed, although the tendency to advance is checked by the fact that there are very large stocks of imported goods on hand.

There has been no open change in the prices of Picks and Mattocks, but some irregularity has prevailed, and the market may be referred to as in the buyers' favor. Notwithstanding the agreement which is understood to exist between the manufacturers, there is some divergence in the quotations made by them, some adhering strictly to the extreme prices which were determined upon, while others show a disposition to make concessions in the way of extra discounts.

The marked increase in the cost of Shot is thought not unlikely to have some effect upon the prices of Loaded Shells. There has, however, as yet been no change in these goods.

Owing the increased duty on Fire Arms, the prices of imported Revolvers are now being materially advanced, and the American manufacturers of the lower grades as well as of the better goods are also advancing their quotations. The market thus shows an advance of from 5 to 10 per cent.

Negotiations between the manufacturers of Horse Nails are still continuing, with a view of reaching some understanding in regard to the control of prices of the better goods. The arrangement recently reached in regard to the cheaper goods is reported to be working very satisfactorily and giving the market an evenness which it has not for some time possessed.

Owing to the general failure of the apple crop, the sale of Apple Parers to the retail trade is this year especially light. Prices are, however, without material change, except that in a general way they may be characterized as slightly lower than last season.

The Tack market remains in the irregular and unsatisfactory condition which has prevailed for some time, there being as yet no adoption of uniform base discounts nor any understanding in regard to the prices at which goods shall be sold. It is understood, however, that some of the manufacturers are conferring with a view to some arrangement by which the business may be put in better shape. It does not, however, appear that any satisfactory conclusions have been reached, and it is thought by well advised parties that any such understanding lies somewhere in the distant future.

The market for Wire has for some time been remarkably steady, and the changes in prices have been unimportant. The demand is reported as good, and the tone of the market is referred to as rather firm.

Luther Boardman & Son, East Haddam, Conn., under date October 13, announce that owing to the high price of silver, nickel, tin, copper, spelter and other materials used in the manufacture of their goods they are obliged to advance the price, and do so by reducing their discount about 10 per cent. It is also intimated that prices will be subject to further change without notice. In view of this advance their Silver Plated Flat Ware may be quoted at a discount of 50 and 12½ per cent., with an additional discount of 5 per cent. for cash in 30 days; their Nickel Silver Flatware at discount 40 and 7½ and 5 per cent. cash, and their Brittania Spoons at discount 50 and 12½ and 5 per cent. cash.

Sandwich Enterprise Company, Sandwich, Ill., issue leaflet circulars relating to their Ratchet Die Stocks, Pipe Vises and Float Valves, illustrations and descriptive matter with list prices being given. The list prices of these goods are as follows and are subject to a discount of 40 per cent.:

Enterprise Ratchet Die Stocks.

Stocks.	Threads Pipe.	Bushings.	Takes Dies.	Special Die Holder.	Price without Dies.
No. 1	¼ to 1½	¼ to 1¼	3 x 3	2 x 2	$10
No. 2	⅛ to 2	⅛ to 1½	4 x 4	3 x 3	15

Dies 2 x 2 for ¼, ⅜ and ½ inch Pipe, each, $1.50.
Dies 3 x 3 for ½, ¾, 1, 1¼ and 1½ inch Pipe, each, $2.50.
Dies 4 x 4 for 1, 1¼, 1½ and 2 inch Pipe, each, $3.50.

Enterprise Improved Pipe Vise.

Capacity from ⅛-inch rod to 2-inch Pipe, price $3.

Enterprise Improved Float Valve.

LIST PRICE, EACH.

¾ in.	1 in.	1¼ in.	1½ in.	2 in.	2½ in.	3 in.
$1.25	$1.38	$1.50	$3.00	$5.00	$7.50	$10.00

The File market continues without special features, and surprise is sometimes expressed that there is not an improvement in prices, those prevailing being regarded as quite low. Reports from manufacturers indicate that a business quite satisfactory in volume is being done.

While there has been no change in the Strap and T Hinge market, the situation is regarded as perhaps slightly improved, the condition being such that the trade would not be surprised if there should be an apparent improvement in prices.

Matthiessen & Hegeler Zinc Company, La Salle, Ill., under date October 8, issue a revised price-list and discount sheet of Sheet Zinc. The price thus announced is $6.75 per 100 pounds for Sheet Zinc in 600-ponnds casks, of the thickness between Nos. 9 to 15, inclusive, and of the width of 32 to 46 inches, and of the length of 84 to 90 inches. The price of selected Sheets, Selected Plates, Battery Plates and LeClanche Bars has also been advanced 25 cents per 100 pounds.

The Amidon Perfect Adjustable Shaft Wringer, manufactured by C. H. Amidon, Buffalo, N.Y., is quoted at $96 per dozen, subject to a discount of 50 per cent. and an additional 2 per cent. for cash in 10 days. An illustrated description of this Wringer is given on page 681.

The Hamden Mfg. Company, Hamden, Conn., successors to William A. Ives & Co., for whom Surpless, Dunn & Alder, 97 Chambers street, New York, are sole agents, have issued a catalogue and price-list of the large line of Boring Implements which they are putting on the market. The catalogue is conveniently arranged, fully illustrated and clearly printed, and shows a large variety of Augers, Auger Bits, Expansive Bits, Spoke Trimmers, Hollow Augers, Braces, &c. The complete line of goods covered by it is indicated in the following discount sheet; terms, 30 days, with 2 per cent. discount for cash in ten days:

Ives' Old Style Nut Augers, ⅝ to 2¼ inch	dis. 70&10 %
Ives' Old Style Nut Augers 2½ to 4 inch	65 %
" Long Bright Rafting Augers	60 %
Short Eye Bright Ring Augers	60 %
Long Eye Bright Ring Augers	50&10 %
Long Millwright Augers	50&10 %
Ives' Boring Machine Augers	70&10 %
Kentucky Post Augers	60 %
Railroad Augers	40 %
Ives' Patent Auger Handles, No. 1, improved	60 %
" " " " Nos. 2 to 3½	40 %
" Cast Steel Car Bits	60&10 %
" Old Style Auger bits	70&10 %
Jennings' Pattern Auger Bits	60 %
Old Style Auger Bits in Fancy Wood Boxes	25&10 %
Jennings' Pattern Auger Bits in Fancy Wood Boxes	25&10 %
Jennings' Pattern Dowel Bits	60 %
Ives' Model Expansive Bits	40 %
" Patent " "	40 %
Extra Cast Steel Sap Bits	60 %
Cast Steel Sugar Bits	40 %
Ives' Spoke Trimmers	50&10 %
" Patent Expansive Hollow Augers	50 %
" " Hollow Augers	25&10 %
Extension Bit Holders	60 %
Screw Driver Bits	60 %
Double Cut Gimlet Bits	60 %
Nail Gimlets	60 %
Double Cut Gimlets	60 %
Ives' Patent Tap Borers	25&10 %
" Genuine Spofford Braces	60 %
" Improved "	60 %
New Haven Novelty Braces	70 %
" Ratchet "	60&10 %
Improved Barber Braces	60&10 %
Barber Ratchet Braces	60&10 %
" Braces	60 %
Improved Farmer Braces	60&10&10 %
Centennial Braces	60 %

An advance has been made by Hermann Boker & Co., 101 Duane Street, New York, in the price of Trenton Anvils, which are now quoted at 10 to 10½ cents per pound.

Inported Goods.

IMPORTERS generally have marked up their goods to the new cost under the revised tariff and report a fair trade. Stocks generally are full and in some instances quite large. It is an open question of considerable interest as to the effect which the new tariff will have on Cutlery, Guns and other lines which are largely advanced, and the importers express themselves as anticipating a falling off in the sale of some goods on which, under the new duties, they will not be in a position to compete with American manufacturers.

In another column revised lists of German Coil and Halter Chains and of John Wilson's Butcher Knives, Steels, &c., are given.

A new list of Joseph Rodgers & Sons' Cutlery is in preparation, in which prices will be revised to conform with the increased duties. In this connection it is proper to contradict a report which has been current in the daily press to the effect that in consequence of the new tariff Joseph Rodgers & Sons are anticipating a withdrawal from the American market.

This report is certainly without foundation, as the goods will be offered to the trade as heretofore, and by well advised parties it is not thought that the increased cost of the goods will result in serious diminution of their sale. The new duties will add something to the price of the goods, but as they have sold on their reputation and quality it is presumed that there will still be a demand for them. They will continue to be represented in this market by F. & W. Clatworthy, 82 Chambers street, New York.

A new price-list of George Wostenholme & Sons' Cutlery, for which Asline Ward is agent, 29 Chambers street, New York, is in preparation. Owing to the large variety of goods covered, this is a matter of some labor, but the list will be issued, it is hoped, at an early date. The trade will be gratified to know that it will be in dollars and cents, instead of English money, as heretofore, as their convenience will thus be promoted.

New lists on Needham Brothers' Cutlery and Wade & Butcher's Razors are also announced.

German Chains.

In consequence of the advanced rate of duty the importers in this city have adopted the new list on German Coil and Halter Chains, which is printed above. In this action the following houses united:

HERMANN BOKER & Co., 101 and 103 Duane street.

ALFRED FIELD & Co., 95 Chambers St.

WIEBUSCH & HILGER, 82 and 84 Chambers street.

McCOY & SANDERS, 26 Warren street.

VOM CLEFF & Co., 105 Duane street.

The new tariff, from the form in which the duty is imposed, causes an uneven advance in the goods, so that the making of a new list was necessary. This list, which bears date October 6, 1890, is above subject to a discount of 60 per cent.

Competition No. 3.

A DECISION has been reached in regard to this competition, which relates to descriptions of approved methods of marking prices for salesmen's use. After careful examination of the many admirable contributions which were submitted, the first prize has been awarded to Theodore Butler, Akron, Ohio, and the second prize to William Todd, Jr., Norristown, Pa. We hope as soon as the pressure on our columns will permit to lay before our readers these excellent papers, which relate to a matter of much practical interest to Hardwaremen.

Items.

THE CARRIAGE BUILDERS' NATIONAL ASSOCIATION hold their annual convention in Chicago this week, the meeting extending from the 14th to the 16th inst. Their headquarters are in the Palmer House, while an exhibition of Carriage Materials is made in Battery D, where the meetings of the association are also held. The annual banquet takes place this evening in the large dining room of the Auditorium Hotel. Over 500 Carriage builders from all parts of the United States are in attendance.

THE CAMBRIA IRON COMPANY, Johnstown, Pa., are now in position to ship orders promptly for their well known Gautier Steel Toe Calks, for the sale of which the Livingston Nail Company, 104 Reade street, New York, are sole agents. They are prepared to supply either city or country patterns, as may be desired.

H. A. WILLIAMS MFG. COMPANY, 22 Milk street, Boston, have opened a branch at 55 Fulton street, New York, and will carry in stock a full line of their Williams, Draper and Syphon Oilers.

JOHN C. SCHMIDT & Co., proprietors of the York Chain Works, York, Pa., have just completed new buildings in order to finish Chains with black Japan finish, a style of finish that is demanded in some sections in place of bright finish, which is ordinarily given to Trace and other Harness Chains. Manufacturing saddlers will be interested in this, as the color of the Chains is the same as the other metal work on Harness. They have also added to their list of manufactured articles Hooks and Dees, such as are used in the lumber regions.

UNDER DATE October 9 it is announced that C. S. Mersick having been appointed receiver to succeed Wm. C. Atwater, who voluntarily resigned, the business of Wilcox & Howe, Birmingham, Conn., will be continued until a new corporation is organized. Isaac P. Howe will continue as manager.

STAVER & WALKER'S Vehicle and Machinery displays at the exposition being held under the auspices of the North Pacific Industrial Association, Portland, Ore., are, we are advised, exceptionally large and interesting. Their Vehicle display occupies the entire south end of Machinery Hall Gallery, the booth being decorated with gold and white bunting, while their Machinery occupies the entire northeast corner of Machinery Hall, with Engine and Machinery in motion.

M. V. LIVINGSTON CYCLE MFG. COMPANY are now to be addressed in regard to agencies, purchase of machines, catalogues, &c., at 245 Columbus avenue, Boston, Mass., their factory being at Westboro. Their announcement of this removal, together with other matter relating to their business, is given in their advertisement on page 63.

WASHBURN & MOEN MFG. COMPANY, Worcester, Mass., in accordance with their custom for several years past, give to their patrons and the trade in a convenient sized book admirably arranged, entitled "Electrical Memoranda, 1890," the facts of the annual growth of the electrical industries in the departments of the telegraph, the telephone and the electric railway, light and power. The improvement in the manufacture of Copper Wire, now being hard drawn for electrical purposes, and its consequent substitution in a large degree for Iron Wire for this work, is fully described. The tables given, showing the dimensions, weight and resistance of pure Copper Wire; comparison of artificial lights, comparison of Wire gauges, &c., as well as other information contained in the book, will be of especial interest to a large circle of readers.

THE ADVERTISEMENT of the Scranton Forging Company, Scranton, Pa., page 92, will be of especial interest, as it illustrates their 1891 pattern Ox Shoe, a modification of the style they have for the past few years been making. It is described as giving additional strength in the web.

THE WELLS RUSTLESS IRON COMPANY, 52 John street, New York, are now putting on the market a Standard Weight Cast Iron Soil Pipe with an extra heavy hub, every length of which is tested to 25 pounds air pressure. Uric acid is said to have no effect on this pipe.

A MEETING of several prominent Freezer manufacturers took place in Philadelphia last week, at which matters of interest to their special trade were fully discussed in a spirit of harmony and good will. The conclusion arrived at was that in spite of the increased cost of raw material, and consequent increase of cost of goods, no advance in price should be made at this present time, and that all manufacturers represented would adopt uniform terms, and would meet again before the close of the year to further discuss matters in their and the trade's interest.

UPSON & WOODING MFG. COMPANY, Kensington, Conn., for whom Surpless, Dunn & Alder, 97 Chambers street, New York, are agents, have recently been putting on the market a line of Leather Halters, on which they are having a very satisfactory trade.

AMONG THE Special Notices on page 59 is one signed "Charles," with reference to the sale of an established business. A clean stock of Hardware, Housefurnishing Goods, &c., in a growing city near New York, with a business of $30,000 annually, is thus offered for sale. The opportunity is deserving the attention of those who are desirous of such an investment.

FOR SOME TIME negotiations have been in progress looking to the control of the manufacture of Wringers by an English-American syndicate. It is understood that the syndicate have already made conditional contracts with the Metropolitan Mfg. Company, New York, the F. F. Adams Company, Erie, Pa., and the Empire Wringer Company, Auburn, N, Y., and that negotiations are now in progress with the Bailey Wringing

GERMAN COIL AND HALTER CHAINS.

	6/0	5/0	4/0	3/0	2/0	0	1	2	3	4	5	6
Coil Chain	$13.50	$11.00	$10.00	$8.15	$7.05	$6.20	$5.60	$5.30	$5.00	$4.90	$4.80	$4.75
4½-feet Halters	....	....	6.60	5.50	4.80	4.15	3.75	3.50	3.25	3.10	3.00	3.00
6 feet Halters	....	....	8.50	7.65	6.00	5.20	4.80	4.50	4.15	4.10	3.95	3.95
Machine Chain	18.00	16.00	14.00	12.75	11.80	11.25	10.70	10.20	10.00	10.00	....	....
Cow Ties:—Ohio Pattern, with 2 Toggles	....	....	4.50	3.80	3.30	....	....	....	....	....	....	....
Closed Ring	....	....	4.50	3.80	3.50	....	....	....	....	....	....	....
Open Ring	....	....	4.75	4.20	3.80	....	....	....	....	....	....	....
Ohio Pattern, with Toggle and Snap	....	....	4.75	4.00	3.50	....	....	....	....	....	....	....

Machine Company, Woonsocket, R. I. A meeting of the stockholders of the latter company will be held October 16 for the purpose of acting on the proposition to sell the plant, business and good will of the company. If they should decide to sell, which is thought by well-advised parties to be likely, it will then remain for the syndicate to accede or not to the proposed terms. The indications are regarded as pointing to the successful carrying out of the plans of the syndicate.

WHEN THE BUSINESS of Richardson Bros., Newark, N. J., was last spring purchased by Henry Disston & Sons there was some apprehension in Newark that the works might be removed to Philadelphia. The Disstons, however, disclaimed any such intention, and steps have since been taken looking to the enlargement of the Newark plant. A new company under the name Richardson's Saw Works has been organized with $400,000 capital to succeed Richardson Bros. The following are the officers and directors: George A. Halsey, president; Sylvester S. Battin, vice-president; Hamilton Disston, of Philadelphia, treasurer; Frederick B. Earle, secretary and superintendent. J. Frank Fort is also a director. Mr. Earle, who has been with the old concern for many years, will be the manager of the present business It is probable that the works will be enlarged and improvements made to accommodate the business, which has already largely increased.

THE CORDAGE MARKET is very firmly in the control of the National Cordage Company, who own or control nearly all the plants in this line. An important part of the company's operations is the control of the raw material, which is furnished by the company to the several factories, which are under contract for long terms to compete with each other in the manufacture of the goods, awards being made to the lowest bidders. The contractors, whether successful or unsuccessful, in bidding, are under obligation by the same contract to maintain the mills at their own expense in a fit state of efficiency for the next annual competitive bid, in which they are obliged to take part. The company point out that they are thus under no expense for idle mills, and that while economies are secured by this plan of organization there is also the advantage of free and keen competition among the manufacturers.

THE FRED J. MEYERS MFG. COMPANY, Covington, Ky., call attention elsewhere in this issue to the satisfactory results obtained in using the Hunter Sifter. Reference is made to the fact that dealers can establish a rapidly increasing business by explaining to their customers the benefits to be derived from the use of this device, and to the fact that the company are willing to furnish full information upon application.

Indurated Fiber Ware.

Condley & Hayes, 173 and 175 Duane street, New York, representing the United Indurated Fiber Company, issue a circular relating to Store Barrels, Fire Casks, Oyster Pails, Florists' Vases, &c., on which the following revised prices are announced, subject to a discount of 25 per cent.

Store Barrels and Fire Casks.

							Per dozen.
No. 1 size,	17 in.	diameter,	30 in.	deep			$50
" 2 "	17 "	"	27 "	"			50
" 3 "	14½ in.	"	30 "	"			40
" 4 "	14½ "	"	27 "	"			40

Dry Store Barrels.

No. 1,	17 in.	diameter,	30 in.	deep		$44
" 2,	17 "	"	27 "	"		36
" 3,	14½ in.	"	30 "	"		33
" 4,	14½ "	"	27 "	"		27

Fire Casks, Complete With Cover and Round Bottom Pail.

No. 2 size,	17. in.	diameter,	27 in.	deep,	will hold 28 gallons, complete with cover and pail	$66

Oyster Pails.

4 quart	size	$7.20
2 "	"	6.60

Florists' Vases.

No. 1,	5½ in.	diameter,	10 in.	deep		$6
" 2,	4½ "	"	9 "	"		5
" 3,	4 "	"	6 "	"		4
" 4,	3 "	"	4½ in.	"		3

Cheese Covers.

No. 1,	16 in.	diameter,	12 in.	deep		$20
" 2,	14 "	"	9½ in.	"		18
" 3,	12 "	"	8 "	"		16
" 4,	11 "	"	6 "	"		14
" 5,	10 "	"	6 "	"		13
" 6,	9 "	"	6 "	"		12

Furnished plain at above prices; lettering extra 3 cents per letter.

Mill Dippers, for Handling Dyes, &c.

2 quart	—size of bowl, 5½ inches deep, 5½ inches diameter	$9.00
1 quart	—size of bowl, 3½ inches deep, 5½ inches diameter	8.00

Beer Trays.

One size only,	11 inch	$3.60

Pickel Tubs for Grocers' Use.

One size,	2 gallons	$4.00

"Sitz Tubs."

No.	0 size,	24 inch	diamerer			$28.00
"	1 "	21 "	"			25.00
"	2 "	19½ "	"			21.00
"	3 "	18 "	"			19.00

John Wilson's Butcher Knives, Butcher Steels, &c.

In consequence of the revised duties, it has been necessary to change the list of John Wilson's Butcher Knives, Butcher Steels, Shoe Knives, &c., for the sale of which Hermann Boker & Co., 101 and 103 Duane street, New York, are sole agents. The following new list is accordingly announced under date October 1, in a circular giving illustrations of the leading goods. The list is subject to a discount of 25 per cent., as before:

BUTCHER, SKINNING AND STICKING KNIVES.

Beechwood Handles.

Nos.	026	26	27	28	
	4½	5	5½	5½	inch.
	$2.10	2.30	2.50	3.15	per doz.
Nos.	29	30	43		
	6	6½	7		inch.
	$3.50	3.90	4 50		per doz.
Nos.	44	45	46	47	
	8	9	10	11	inch.
	$5.75	6.90	9.50	11.10	per doz.
Nos.	48	49	86		
	12	13	14		inch.
	$12.60	14.60	18.80		per doz.

Rosewood Handles.

Nos.	26R	28R	29R	
	5	5½	6	inch.
	$3.30	3 75	4.15	per doz.
Nos.	30R	43R		
	6½	7		inch.
	$4.50	5.30		per doz.
Nos.	44R	45R	46R	
	8	9	10	inch.
	$6.50	7.70	10.70	per doz.
Nos.	47R	48R		
	11	12		inch.
	$12.30	13.80		per doz.

FRENCH PATTERN COOK KNIVES.

7	8	9	inches.
$9.90	10.30	10.70	per doz.
10	11	12	inches.
$11.50	14.45	15.20	per doz.

HAM SLICERS.—ROSEWOOD HANDLES.

10	11	12	13	inches.
$10.90	14.25	15.75	18.10	per doz.

BONERS.

Boning Knives, Rosewood Handles	6½ inches, $5.70
Boning Knives, Beechwood Handles	6½ inches, $5.10

BUTCHER'S STEELS.

Polished Blackwood Handles, No. 54.

8½	9	10	11	inch.
$5.30	6.90	7.90	9.90	per doz.
12	13	14		inch.
$11.00	12.50	13.80		per doz.

Stag Handles (Through Tang) No. 65.

9	10	11	inch.
$10.70	11.70	12.60	per doz.
12	13	14	inch.
$13.80	15.00	16.50	per doz.

Stag Handles (Through Tang with Swivel), No. 66

9	10	11	12	inch.
$11.50	12.90	13.80	15.00	per doz.
13	14	16		inch.
$16.10	17.70	21.95		per doz.

Inlaid Handles (Through Tang with Swivel), No. 82.

9	10	11	12	inch.
$11.90	12.90	13.80	15.00	per doz.
13	14	16		inch.
$16.10	17.70	21.95		per doz.

SHOE KNIVES, SQUARE OR ROUND POINT.

No.				Per doz.
1,	Sq. Point,	4½	in	$1.30
01,	Rd. "	4½	"	1.30
08,	Sq. "	4½	" Refined Steel	1.40
09,	Rd. "	4½	" "	1.40
8,	Sq. "	5	" "	1.55
12,	" "	6	" "	2.40
13,	" "	6½	" "	2.70

FARRIER'S KNIVES.

Large, Medium, Assorted and Searchers	$3.90

The Care of Price-Lists.

BY D. T. MALLETT.

The following method is based on a general Hardware business; where parties deal largely in Heavy Hardware, however, it is of equal value, with some individual modification.

The fixtures needed in this method consist of an adjustable double book rack, 21 drawers, 5 blank scrap books, a general index book and a number of blank forms.

The manufacturers' price-lists and catalogues are divided when received into four classes: 1. The heavy bound catalogues, like Sargent & Co.'s, P. & F. Corbin, &c. 2. The medium sized bound catalogues, like the Stanley Works, &c. 3. Paper bound catalogues like Millers Falls Company. 4. The separate sheets or single folded price-lists. As to their disposal: The first and second class are arranged according to hight in the book rack, the taller ones on the bottom row. This rack, Fig. 1, is divided into 42 spaces by adjustable upright divisions, in order to separate the catalogues and adapt the size of space to the varying thickness of the books, in alphabetical order.

The third class are placed in the 21 drawers, also in alphabetical order.

The fourth class are gummed on the top edge and pasted one or more to a page in one of the five scrap books. These five scrap books are arranged as follows: Book No. 1 is marked on the back "A to

E," Book No. 2 is marked "F to J," Book No. 3 "K to M," Book No. 4 "N to S," Book No. 5 "T to Z." These scrap books are individually marked on the backs No. 1, 2, 3, 4 and 5. The general index book referred to is a large size, well bound ledger index.

The blank forms referred to are single sheets of white paper, size about 8 x 4 inches, ruled and printed as Fig. 2.

The application of the system is as follows: Upon receipt of a catalogue, if we wish to preserve it, we paste on the front cover one of these blank forms, which we

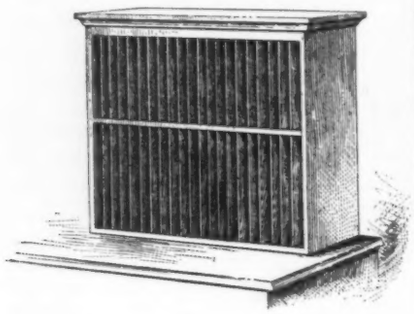


Fig. 1.—Book Rack with Adjustable Partitions.

number consecutively as received. For example: Suppose we have just received by mail a catalogue from the Stanley Rule and Level Company, after pasting a blank form on the cover, we would write their name at the top of form. If we had on hand 99 other catalogues under letter "S" (we know the number in drawer by marking the last number put in on the side of drawer), we would number this one "S-100," and the date received, or issued. If there was a discount sheet inside we would paste or pin it to the first fly leaf, and if there were extra special discounts, mark them in cipher on the margin of the discount sheet. We would then proceed with our blank form as follows:

Rules—Boxwood	Page	3 to 10
" —Ivory	"	11-14-15
" —Miscellaneous	"	12-13
Plumbs and Levels	"	16-20
Levels—Iron	"	21
Squares—Try	"	22-25-26
" —Miter	"	23-24-25
Bevels—Sliding "T"	"	27

and so on throughout the catalogue. There is probably an index printed in each catalogue, but the one we make being uniform in size, and very much condensed, can be seen without opening the catalogue, and is more practicable in connection with our general index book.

The next operation is to take our general index book, and opening same to letter "R," enter as follows:

Rules—Boxwood, ÷S-100.
" Ivory, S-100.
" Miscellaneous, S-100.

Under letter "P" enter:

"Plumbs and Levels, ÷S-100."

Under letter "L" enter:

"Levels, Iron, ÷S-100."

And so on with the prepared blank No. S-100.

The catalogue is then ready to put away, and as it comes under the third classification (being paper cover), is placed in drawer "S," Fig. 3. If the catalogue was a bound book like Sargent & Co.'s, we would, in addition to the blank form, place the number (written on gummed labels) on the back, that it might show when in position in rack.

The separate sheets or single folded price-lists which, as stated and described, are pasted in the proper scrap book, are arranged in the general index book as follows: Suppose the circular refers to Axle Grease, and is pasted, say, on page No. 150 of scrap book No. 1, Fig. 4 (A to E). Opening index book to letter "A," we write: "Axle Grease, B-1, P. 150." Any quotations received with circular are noted, in cipher, on the margin of the circular, when it is placed in scrap book, and also a date and number, referring to

CATALOGUE OF _____ No. _____

RECEIVED _____ 18____

LINE OF GOODS	PAGE

This catalogue belongs in drawer No. _____

Fig. 2.—Blank Form for Covers of Catalogues.

the letter containing said quotation, which latter is arranged in our Amberg Cabinet Letter File.

Now for an illustration of the practical working of this method. Suppose a customer wishes to look at, say, a Stone Hammer. We show him what we have in that line in stock, and, after looking them over, he says that they are not the right shape for his purpose. Presuming that sale of Stone Hammers is very limited with us, we inform him that we can probably procure him what he wants. His natural reply would be that he would prefer to see it before leaving his order. We then state that we can show him illustrations of different kinds, and description of their sizes, weights, &c., from which he can make a selection; to which he acquieses. This affords us an opportunity, you will notice, to take an order for goods not kept in stock, and also notice that it is just at this point where our system gets in its work. If Stone Hammers are not familiar with goods to us, we can only, perhaps, recall the name of one maker, and this happens, of course, to be the very maker whose goods we have in stock, and which, as stated, do not fill the requirements of our customer. We have a sort of hazy idea that somewhere among our 2500 odd catalogues there are other makers of these goods, but time is short,

Fig. 3.—Case of Drawers for Paper Covered Catalogues.

and memory overtaxed, and customers becoming impatient. At this juncture we calmly open our index book, and, turning to "H," find "Hammers—Stone, A-98, H-17," &c. We turn at once to drawer "A," and taking out catalogue No. 98, hold in our hand the Athol Tool Company's catalogue. The proper page for Stone Hammers is shown at a glance from

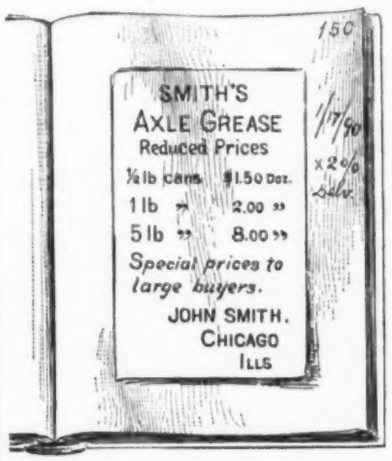


Fig. 4.—Scrap Book No. 1.

our blank form, which is, as stated, pasted on the cover. Should none of the goods therein described suit the needs of our customer, we turn to drawer "H" and remove catalogue No. 17, being H. Harvey's catalogue of Hammers, and so on (with only one reference to index book) until we have exhausted our line of catalogues bearing on the subject of Stone Hammers. If we do not find what customer wants, it is because the manufacturer has neglected to supply us with his catalogue, and not because we have neglected to care

for our end of the business. Even if we do not find what customer wants, he may have been shown some style which he will substitute, and in any event we have convinced him that we are posted in what pertains to this branch of goods, and have obtained his good will.

In orders by mail. or in selecting our purchases for stock, or in comparing competing lines of goods, this system meets all the requirements. The system is equally adapted to a large or small house, and any bookkeeper can at odd moments during one month arrange the catalogues on hand, after which it is easily kept up, and the least informed clerk in the store can find lines of goods wanted readily. The bottom of the blank forms has printed on them: "This catalogue belongs in drawer Letter ——," so that all future misplacing is avoided.

Price-Lists, Circulars, &c.

WITHINGTON & COOLEY MFG. COMPANY, Jackson, Mich., send us their illustrated catalogue of Steel goods, Wheelbarrows and Corn and Hay Knives for 1891, including new list prices on Farm and Garden Tools. The supply of these goods last year is stated to have been inadequate to the demand, and the supply for the year to come will be still less. They refer to the fact that if they hold their trade of last year it will be simply impossible for them to take new customers. They will give their old customers the first opportunity, and suggest they do not wait for a personal visit. They have no agents, and do only such traveling as can be done by the company's officers.

Smith & Wesson, Springfield, Mass., manufacturers of Revolvers, send out a handsome and well arranged catalogue of these goods, also a separate price-list. The goods of this representative firm are so favorably known by the trade that a detailed description is unnecessary. The catalogue is well printed on fine paper; the cream tinted covers, decorated with copper bronze, are fastened with linen hinge, making them durable and attractive. Besides illustrations of Revolvers, Reloading Tools, Special Sights and component parts of their Revolvers are referred to.

The Udell Woodenware Works, A. A. Barnes, proprietor, North Indianapolis, Ind., issue a catalogue for the fall of 1890 and the spring of 1891, devoted to Fancy Cabinet Ware, Woodenware Specialties, Ladders, &c. In presenting this catalogue they state that some important additions have been made to their Furniture line, and that they have endeavored to improve the style and finish of these goods.

Wickwire Brothers, Cortland, N. Y., manufacturers of Wire Cloth and Wire Goods, send us an illustrated catalogue and price-list. They refer to their excellent facilities for manufacturing in large quantities. Particular attention is directed to the production of Wire Cloth.

Frasse & Co., 92 Park row, New York, importers and dealers in Tools, Files, Machinery and Supplies, are sending out a circular of their Improved Wire Cutter. This is made in two sizes, Nos. 1 and 2, and cuts from 0 to ¼ inch. The Shear or Cutter is referred to as leaving the end of the wire as smooth as if cut off in a lathe, thereby saving time, it not being necessary to file the end to remove the burr. A sliding gauge provides a means of measuring the accuracy of the length of cut.

The Gilbert & Bennett Mfg. Company, Georgetown, Conn., and Chicago, Ill., with Eastern office 42–44 Cliff street, New York, issue a fall catalogue, No. 114, of Wire Goods, Wire Cloth, Netting, Fencing and Gates. This price-list is fully illustrated, showing these goods in various styles and sizes. An explanation is made in a note to the trade that in this catalogue it is their aim to present only such goods in their line as are in demand at this season, and it is to be understood that it does not include their entire assortment.

The Oswego Indurated Fiber Company, Oswego, N. Y., issue an illustrated catalogue of their Indurated Fiber Bathtubs, Laundry Trays, Flushing Tanks, Closet Seats, &c. In describing these goods, they state that the material from which the Tubs are made is pure wood fiber, molded in one piece under heavy pressure, without joint or seam. The rim of the Tub is also part of this one piece, the material a non-conductor, and the pores of the fiber are filled with an indurated material. The inner surface is lined with white or tinted enamel, the outside being white or, in baking, is given a mahogany, rosewood or oak finish. The desirable features are referred to as being a handsome article of furniture, their cleanliness, ease of care, durability, lightness, economy in use of hot water, compliance with the latest sanitary regulations, and cheapness. They inclose *fac-simile* letters from architects, sanitariums, plumbers, &c., testifying to the satisfaction these Tubs are giving in actual use. The catalogue is elegantly printed in colors on paper of superior quality.

Surpless, Dunn & Alder, 97 Chambers street, New York, are agents for the Western Block Company, Lockport, N. Y., who have recently issued a price-list of their goods. In addition to the regular line of Blocks, it is observed that they are offering a line of Wrought Iron Blocks, including Snatch Blocks, Blocks for Wire Rope, &c. The list is well arranged and indicates the enterprise of the company issuing it.

Andrew J. Morse & Son, 140 Congress street, Boston, Mass., issue a catalogue of Fire Department Supplies, Mill Supplies, and Submarine Armor. They refer to the fact that, having been engaged in this business for many years, and having had an extended experience with heads of departments and chief engineers, they feel fully qualified to supply any article in these lines, and of such quality of material and workmanship as shall entirely meet the requirements of their patrons.

The Franklin Moore Company, Winsted, Conn., manufacturers of Carriage, Tire, Sleigh Shoe and Fancy Bolts and Norway Iron Rivets, send us their new illustrated price lists and discount sheets for 1890; printed in English for home and in Spanish for foreign trade. They refer to their trade as constantly on the increase, this season's home trade being better than usual, while foreign trade is such as to demand their special attention.

The Logan & Strobridge Iron Company, New Brighton, Pa., manufacturers of Coffee Mills, Farm and Plantation Mills, Builders' Hardware, Housefurnishing Goods, &c., issue circular No. 3, devoted to fall goods. This illustrates Fire Iron Stands, Cottage Kitchen Sets, Fire Irons, Fire Shovels and Umbrella Stands.

The Spiral Weld Tube Company, East Orange, N. J., issue a price-list illustrating the Spiral Weld Tubes and Couplings manufactured by them. The Tubes are made in light standard, heavy and extra heavy grades. They also show their Self-locking Sleeve Coupling, Standard Flanges, Standard Hubs and Spigots, and Self Packing Lead Joints. They state that all pipes are tested before shipment, from 3 to 14 inches to 300 pounds per square inch; and 16 to 24 inches to 200 pounds per square inch; although higher mill tests are made when required. Spiral Weld Tubes, finished with their standard joints, may be coupled to cast iron or lap-welded pipes or fittings to corresponding diameters. Special couplings and fittings are furnished for unusual service.

Exports.

PER BARK SOUTHESK, SEPTEMBER 9, 1890, FOR SYDNEY, N. S. W.

By J. L. Mott Iron Works.—4012 pounds Stoves.
By W. K. Freeman.—1 case Drills.
By A. James.—575 pounds Windmills.
By Eureka Fire Hose Company.—800 feet Hose.
By Meriden Britannia Company.—20 boxes Plated Ware.
By A. S. Lascelles & Co.—6 dozen Axes.
By L. D. Crossmond & Co.—200 pounds Meat Choppers.
By C. B. Seabury.—5 cases Hardware.
By A. Field & Sons.—13,985 pounds Iron Nails.
By Morris, Strouse & Co.—60 dozen Axe Handles.
By R. W. Forbes & Son.—2 cases Machinery.
By Healy & Earl.—1 box Blacksmiths' Drills, 6 cases Pumps.
By Ilsley, Doubleday & Co.—5 gross Tools.
By E. W. Harrison.—8 cases Steel Picks, 1 box Hardware, 3 boxes Pumps.
By V. Basanta.—1½ dozen Lawn Mowers, 1 dozen Refrigerators, 12 dozen Spade Handles, 9 dozen Sieves, 1½ dozen Wringers.
By Strong & Trowbridge.—3 cases Axes, 2 dozen Hardware, 11 dozen Hatchets, 13 gross Lead Pencils, 1 case Springs and Axles, 6 Chucks, 6 Lawn Mowers, 6750 pounds Bolts, 6 dozen Lamp Ware, 6 Stoves, 15 dozen Hardware.
By McLean Bros. & Rigg.—49 dozen Axes, 20 dozen Hammers, 12 dozen Rat Traps, 30 dozen Gate Latches, 36 dozen Brushes, 11 dozen Wrenches, 3 dozen Wringers, 6 dozen Braces, 2 dozen Planes, &c., 2 dozen Corn Mills, ¾ dozen Wringers, 20 dozen Drills, 50 dozen Door Springs, 22 cases Agate Ware, 11 cases Agate Ware, 1 gross Can Openers, 12 dozen Hoes, 24 dozen Egg Beaters.
By the F. B. Wheeler Company.—1 case Plated Ware, 8 Pumps, 1 case Hardware, 2 dozen Axes, 1 case Hardware, 4 dozen Axes, 6 dozen Hatchets, 2 cases Hardware, 6 cases Wringers, 20 packages Hardware, 1 dozen sets Axles, 2 dozen Hammers, 1 case Hardware.
By R. W. Cameron.—22 packages Hardware, 18,165 pounds Axles, 2 cases Lamp Goods, 7 packages Mining Machinery, 5 boxes Tools, 2 boxes Wood Working Machinery.
By W. H. Crossman & Bro.—2½ dozen Grindstone Fixtures, 9 boxes Carpenters' Tools, 1 dozen Axes, 6 dozen Traps, 7 cases Plow Parts, 1 case Hardware, 6 packages Carpenters' Tools, 2 dozen Hay Knives, 6 dozen Razor Strops, 1 gross Hammers, 4 dozen Wringers, 1 dozen Blocks, 2 dozen Door Checks, 2 Boring Machines, 1 Tire Bender, 1022 pounds Iron Bolts, 2 gross Hammers, 5 dozen Wringers, 40 dozen Axes, 50 sets Axles, 19 packages and 8 cases Hardware, 6 dozen sets Sad Irons, 2 gross Egg Beaters, 3 packages Plated Ware, 12 Stoves, 50 Seed Sowers, 4 dozen Squares, 42 dozen Hammers, 77 Scales, 54 Churns, 45 dozen Wrenches, 18 Miter Boxes, 28 dozen Cow Bells, 36 Corn Shellers, 6 dozen Hay Forks, 1 dozen Tills, 5 packages Hardware, 20 dozen Hatchets, 100 dozen Axes, 224 pounds Stone, 18 dozen Cow Bells, 6 dozen Traps, 1 gross Transom Lifters, 10,000 Cartridges, 18 dozen Wrenches, 1 Gross Razor Strops, 8 cases Hardware, 56 pounds Stone, 8 dozen Hammers, 10 dozen Axes, 1 case Hardware, 15 dozen Springs, 2 cases Hardware, 8 dozen Axes, 1 dozen Forks, 2 dozen Lanterns, 20 dozen Axes, 2 gross Whips, 54 dozen Whip Handles, 122 dozen Whips.
By H. W. Peabody & Co.—1 case Step Ladders, 120,000 Rivets, 11 cases Hardware 12 Shellers, 7 cases Edge Tools, 2400 pounds Nails, 200 pounds of Nails, 20 reams Flint Paper, 1 case Iron Castings, 4 cases Pumps, 126 cases Fruit Jars, 5 cases Hardware, 4 cases Iron Castings, 26 dozen Hammers.

PER SHIP CRICCIETH CASTLE, SEPTEMBER 10, 1890, FOR MELBOURNE, AUSTRALIA.

By Bissell Carpet Sweeper Company.—17 cases Carpet Sweepers.
By Edward Miller & Co.—5 packages Lamp Goods.
By Bradley & Hubbard Mfg. Company.—17 packages Lamp Goods.
By Fairbanks & Co.—1775 pounds Scales.
By Dunbar, Hobart & Co.—8960 pounds Nails.

By R. H. Dana & Co.—109 dozen Axes.
By De Grauw, Aymar & Co.—1971 pounds Manila Rope.
By Arnold, Cheney & Co.—275 pounds Iron Castings.
By W. K. Freeman.—3500 Shells.
By Coombs, Crosby & Eddy.—13 dozen Hardware.
By F. B. Wheeler & Co.—25 dozen Axes, 30 sets Axles.
By Mailler & Quereau.—2650 pounds Axles
By Welsh & Lea.—10 cases Hardware, 4 packages Plated Ware, 1 case Hardware, 2 cases Forks, 11 cases Laundry Machinery.
By A. Field & Co.—2 dozen Tools, 2 dozen Wringers, 2 gross Axle Grease, 24 dozen Axle Grease.
By R. W. Forbes & Son.—12,000 Cartridges, 32 Washing Machines, 5500 Cartridges, 2 dozen Thermometers, 3 gross Adhesive Hooks, 3 dozen Sash Cord, 8¼ dozen Wrenches, 16 packages Hardware, 3 dozen Wrenches, 14,000 Bolts and Washers, 8 packages Carriage Hardware.
By Strong & Trowbridge.—25 kegs and 500 pounds Nails, 3 dozen Bush Hooks, 8 dozen Padlocks, 1 dozen Banks, 60 pounds Hardware, 1 dozen Mangles, 10 dozen Door Springs, 2 dozen Forks, 55,000 Rivets, 21¼ gross Lampware, 34 Pumps, 15¼ dozen Locks, ⅛ dozen Nail Pullers, 9 dozen Beflectors.
By R. W Cameron & Co.—2 boxes Nuts and Bolts, 2 cases Hardware, 2 cases Axles, 1 case Hardware.
By H. W. Peabody & Co.—18 cases Skewers, 1 case Iron Castings, 22 cases Hardware, 4 dozen Wringers, 1 package Iron Castings, 12 sets Axles, 1 case Hardware, 8 dozen Brushes, 9500 pounds Nails, 17 cases Hardware, 2 cases Sandpaper, 36 packages Dies, 2640 pounds Nails, 30 sets Axles, 2 cases Iron Castings, 4 cases Wringers, 1 case Blocks.
By W. H. Crossman & Bro.—3 dozen Shears, 5 cases Hardware, 28 Stoves, 3 dozen Wringers, 10 gross Traps, 32 dozen Broilers, 4 dozen Wringers, 1 gross Traps, 8 dozen Cow Bells, 8½ dozen Forks, 41 Pumps, 10 cases Hardware, 12 dozen Snaths, 36 gross Tacks, 24 cases Hardware, 2 gross Axle Grease, 1 dozen Grindstone Fittings, 4 cases Hardware, 1 case Hardware, 1 gross Sinks.
By H. W. Peabody & Co.—3 cases Bolts, 1 case Transom Lifters.
By McLean Bros. & Rigg.—1 case Platad Ware, 1 dozen Wrenches, 19 sets Casters, 1800 pounds Nails, 1 dozen Stoves, 12 dozen Gate Latches, 106 dozen Axes, 39 sets Stocks and Dies, 1 cask Plated Ware, 9 Stoves, 43 dozen Drills, 1 gross Can Openers, 1 case Tacks, 1 dozen Toy Banks, 1 case Carriage Hardware, 23 packages Harvesting Machinery.

PER BRIG DA CAPO, SEPTERBER 16, 1890, FOR PORT NATAL, SOUTH AFRICA.

By Samuel Lees & Co.—6 cases Wood Working Machinery.
By Coombs, Crosby & Eddy.—20,000 pounds Barb Wire, 8½ gross Axle Grease, 16 Meat Cutters, 9 Churns, 200 dozen Axes, 29 dozen Tools, 14 gross Hardware, 2 dozen Garden Sets, 1 Drill, 8 Oil Stoves, 15½ dozen Lamp Goods, 10 dozen Carpenters' Tools, 15 dozen Wrenches, 14 dozen Traps, 30 dozen Hardware, ½ dozen Tobacco Cutters, 100 pounds Oil Stone, 32 dozen Saws.
By John Norton & Son.—32 dozen Corn Shellers, 24 dozen Cultivators, 20 dozen Axes, 106 dozen Hatchets.
By H. W. Peabody & Co.—4 packages Road Carts.
By Corner Bros. & Co.—96 cases Agricultural Implements, 1 case Hardware.

PER BARK VALPARAISO, SEPTEMBER 15, 1890 FOR WELLINGTON, NEW ZEALAND.

By Arkell & Douglas.—7 dozen Traps, 12 dozen Saws, 36 pounds Castings, 2 dozen Wringers, 30 dozen Traps, 10 dozen Bush Hooks, 12 dozen Saws, 18 dozen Wire Goods, ½ dozen Stoves, 1 dozen Cages, 2⅜ dozen Saws, 2 Stoves, 60 dozen Lampware, 89 Castings, 4 dozen Rat Traps, 1 case Pumps.
By R. W. Forbes & Son.—2 dozen Plated Ware, 22 packages Churns.
By G. B. Nicholson.—1 box Iron Pumps.
By Arnold, Cheney & Co.—600 pounds Axes.
By Henry Disston & Sons.—327 pounds Saws.
By Boston and Lockport Block Company.—1505 pounds Pulley Blocks.
By Dunbar, Hobart & Co.—8400 pounds Nails.
By Alfred Field & Co.—7 Stones, 5 dozen Tinware, 2 dozen Wringers, 2 dozen Hardware, 36 dozen Axle Grease.
By W. H. Crossman & Bro.—1 package Hardware, 3 dozen Thermometers, 10 Stove Trucks, 4 dozen Wire Mattresses, 14 dozen Hardware, 3 packages Pulley Blocks, ½ dozen Wagon Jacks.
By McLean Bros. & Rigg.—2 Corn Shellers, 3 sets Die Stocks, ¼ dozen Lemon Squeezers, 2 barrels Hardware, ½ dozen Coffee Mills, 1 gross Can Openers, 5 dozen Axes, 1 case Broilers, 2 dozen Wringers, 105 dozen Axe Handles, 22 Meat Choppers, 18 dozen Axes, 2 Drills, 2 dozen Cork Pullers, 28 Pumps, ½ dozen Wringers, 3½ dozen Plumbs and Levels, 1 dozen Carpet Sweepers, ½ dozen Mangles, 4 cases Agateware, 2 packages Silver Plated Ware, 1 gross Fly Killers, 2 packages Lampware, 1 dozen Sifters, 3 cases Lampware, 15 dozen Axes, 1 dozen Potato Forks, 4 packages Tool Racks, 10 dozen Hay Forks.
By Strong & Trowbridge.—2 cases Hardware, 2 packages Pumps, 12 gross Pencils, 1 dozen Sad Irons, 5 dozen Brushes, 6 dozen Axes, 18 dozen Mouse Traps, 3 dozen Hardware, 9 dozen Axes.

FOR AUCKLAND.

By Arkell & Douglas.—3 sets Springs, 6 gross Hardware, ½ dozen Anti-Rattlers, 3 dozen Door Springs, 1 dozen Saws.

FOR DUNEDIN.

By R. W. Forbes & Son.—4 packages Axes and Wringers, 3 dozen Hardware, 1 case Hardware, 35 boxes Horse Nails, 13 packages Axes and Choppers, ½ dozen Rakes.
By Arkell & Douglas.—16 dozen Saws, 189 pounds Saw Frame Castings, 6 dozen Rakes, 5 dozen Wrenches, 16 dozen Forks, 2 dozen Wringers, 3 dozen Meat Choppers, 1 dozen Molasses Gates, ½ dozen Lawn Mowers, 1 dozen Sad Irons, ½ dozen Fruit Presses, 7 crates Fruit Jars, 3 dozen Pumps, 10 dozen Hoes, 1 gross Traps, 3 gross Oil Stones, 10 dozen Snaths, ½ dozen Saws, 125 pounds Nails, 3¼ dozen Drills, ½ dozen Knives, 6 gross Snaps, 13 dozen Hoes, 2 cases Bolts, ½ dozen Augers.

PER BARK BRAZIL, SEPTEMBER 19, 1890, FOR PORT NATAL, SOUTH AFRICA.

By Strong & Trowbridge.—1 dozen Meat Cutters.
By H. W. Peabody & Co.—4 cases Hardware, 6 sets Axles, 2 packages Hoes, 21 Wringers, 1 dozen Seed Sowers, 2 packages Hardware, 1 barrel Lampware, 1 case Fruit Jars.
By Coombs, Crosby & Eddy.—96 Plows, 30,000 pounds Barb Wire, 10,000 pounds Barb Wire, 24 Plows, 18 Ladders, 6 dozen Hay Forks, 2 dozen Wrenches, 200 pounds Oil Stone, 10 dozen Braces.
By W. H. Crossman & Bro.—20 dozen Hardware, ¼ dozen Hand Carts, ⅛ dozen Trucks, 1 dozen Washing Machines, 93 cases Agricultural Implements, 30,000 pounds Barb Wire, 5 crates Washing Machines, ¼ dozen Hand Carts.

REVIEW OF THE WHOLESALE MARKET IN PAINTS AND OILS.

It should be understood that the prices quoted in this column are strictly those current in the wholesale market, and that higher prices are paid for retail lots. The quality of goods frequently necessitates a considerable range of prices.

Paints and Colors.

White Lead.—The enhanced cost of raw material has caused a further advance in corroders' prices for the pigment, and the market is in such shape that present or even higher prices will likely prevail during the balance of the year. At the last advance White Lead is relatively lower in price than the domestic crude material for immediate delivery and about on a parity with the present market value of foreign Pig for delivery late in the year. The high cost naturally causes buyers to proceed cautiously, but both corroders and jobbers assert that the current movement is in line with what is customary at this season of the year. The new list, which shows ¼¢ ℔ lb advance, is as follows:

Kegs, dry or in Oil:	Per lb.
Lots of less than 1000 lb.....	7¾¢
" " 1000 lb to 5 tons.....	7¼¢
" " 5 tons to 12 tons.....	7⅛¢
" " 12 tons and over.....	7 ¢
For 25 lb tin pails, add to keg price.....	½¢
" 12½ lb " " "	1 ¢
" 1 lb @ 5 lb assorted tins, add to keg price.....	2½¢

Discount, 2½ % for cash in 15 days.

The cheaper varieties (adulterated) of Lead have undergone no change, the it is considered probable that manufacturers of the better sorts will raise their figures should the advance on pure pigment turn out to be permanent.

Red Lead and Litharge.—Prices for these commodities have been advanced the same as White Lead. Otherwise the market is featureless, there being merely the routine trade. The revised list is as follows:

	In kegs.	In barrels or half barrels.
Lots of less than 1000 lb..	7¾¢	7¼¢
" 1000 lb to 5 tons..	7¼¢	7 ¢
" 5 tons to 12 tons..	7⅛¢	6⅞¢
" 12 tons or over...	7 ¢	6¾¢

Discount, 2½ % for cash in 15 days.

Zincs.—There has been no further change in prices of American Oxide, and the market is without new feature, save that some large buyers have manifested more disposition to place orders in view of the strong position of the market. Foreign brands are very firmly held and selling to about the usual extent.

Colors.—Prices for Orange Mineral have been advanced about ½¢ ℔ lb on account of the increased duty. Otherwise there have been no changes in prices, but the market for the general line of house painters and grinders' colors remains firm and business is of a very fair volume.

Miscellaneous.—No striking change has taken place in prices for Chalk, Whiting, Paris White or Clays. The market for the several commodities remains quite steady in tone, but current business is of unimportant character.

Oils and Turpentine.

Linseed Oil.—Local manufacturers have made no change in their prices, and Oil from outside sources is offered no more freely nor at lower prices than have ruled since the beginning of the month. In other words, the market remains in *statu quo*, and there is little chance of any change unless the cost of raw material drops considerably. The current movement is of routine character, and fully up to the average for the season in volume.

Cotton Seed Oils.—Refined product is moving off in moderate quantities, and the crude article finds rather slow sale, there being no real live interest on the part of either home trade buyers or exporters. From the South it is reported that seed comes forward slowly and that the quality is poor. The average quality of Oil received here is undoubtedly low, and while strictly prime stock may be worth a little more money on its merits, the general market is no better at the present time than it was a week ago.

Lard Oil.—For the best city brands of present make prime 51¢ is still generally asked. Business has been done at 50½¢, however, and sales of good out of town makes at 50¢ are noted, which would indicate a rather weak market. The home distribution is fair, but export movement moderate.

Fish Oils.—No new movement of importance in crude Menhaden or Sperm Oils comes to notice, and the demand at present is moderate. Still, the position of supplies is fairly good, and prices for the manufactured as well as the crude product remain very steady.

Miscellaneous.—Olive Oil in barrels has been sold at 68¢ @ 68½¢, to arrive, but the market has hardened somewhat the past few days, and spot lots are not offered at less than 72¢ at the moment. Cocoanut Oils remain in strong position, but prices have not changed during the past week. Palm is also firm and selling to a very fair extent.

Spirits Turpentine.—The home trade distribution at this point has been very fair, and advices from Southern markets note a good movement there. Prices are steady at 40½¢ @ 41¢ here.

The Lawrence Safety Check Rein Guard.

The Lawrence Curry Comb Company, 204 and 206 East Forty-third street, New York, are introducing a safety check rein guard, as illustrated in Figs. 1 and 2. Fig. 1 shows it in use, while Fig. 2 gives the

Fig. 1.—The Lawrence Safety Check Rein Guard.

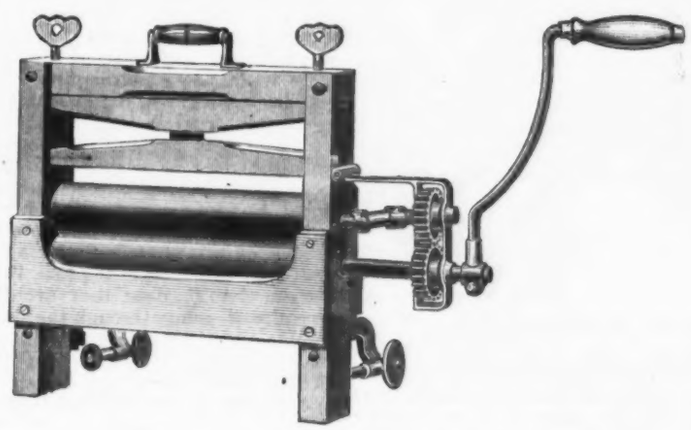
guard separate from the saddle. Its use is obvious, and the statement is made that the natural spring of the rubber, of which it is made, makes it impossible for the

Fig. 2.—Check Rein Guard Separate from the Bolt Hook.

guard to come off the hook, except when taken off by hand, consequently there is no possibility of the check rein getting loose. It is alluded to as being better than a snap hook, as there are no springs to get out of order.

The Amidon Perfect Adjustable Shaft Wringer.

E. H. Amidon, Buffalo, N. Y., manufacturer of bit braces, is introducing a wringer, as illustrated herewith. The iron parts are galvanized. The crank is made of steel, and prevented from turning on the shaft by a groove in the shaft, to receive part of the machine bolt with which the crank is attached. The upper shaft has double knuckle joints, which allow the roller to adjust itself as articles

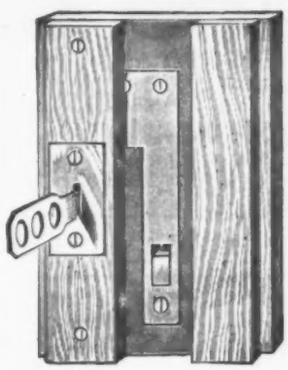


The Amidon Perfect Adjustable Shaft Wringer.

are passed through the wringer, thus avoiding the friction of cog wheels resulting from one end of the shaft being higher than the other. The clamps can be swung around flush with the front of the wringer when not in use. The wringer is thus adapted for fastening to square stationary tubs or to round wash tubs. A handle on the top makes it convenient to carry. The cogs running on the outside of the tub prevent rust or grease dropping on the clothes. The point is made that the cogs are always in mesh and cannot be thrown out of gear by wringing a large article. These are made in one size only, 12 inch frame. The price for the wringer will be found in the Trade Report of this issue.

The Giant Sash Lock.

The I. G. Jenkins Mfg. Company, Oswego, N. Y., are introducing a burglar proof sash lock and ventilator, as illustrated herewith. This lock is provided with a key having a notch on the lower edge which engages on the lower edge of the face plate when the key is pushed in, thus holding the bolt back and allowing the sash to be raised or lowered as desired. The sash is locked by removing the key. The lock is heavy brass and particularly



No. 131 Giant Burglar Proof Sash Lock and Ventilator.

adapted to large and heavy sash. If desired, a push pin and face plate similar to the one on the Perfection lock, which is manufactured by the same company, and was described in a recent issue of *The Iron Age*, may be used instead of the key.

Silver's Steam Cooker.

Silver & Co., 56 Warren street, New York, are putting on the market a steam cooker, as illustrated herewith, in which some new and novel features are shown. The manufacturers claim that it is the only absolutely steamless and odorless cooker on the market, and especially allude to its being the only steamless and odorless cooker for gas, oil or gasoline stoves. A hot air jacket surrounds the kettle; this jacket is designed to keep all the heat against the kettle which contains the food, and it is claimed by this arrangement to make a saving of one-half the fuel. Any excess of steam in the cooker is intended to escape through the small opening inside the kettle into the hot air jacket and there to evaporate.

The cover of the cooker is made to rest in a water groove. This arrangement is to

Silver's Steam Cooker.

answer the purpose of a seal and is designed to prevent any vapors escaping from beneath the cover. Prices of this cooker will be found in our Trade Report of this issue.

Indurated Fiber Cheese Covers.

The United Indurated Fiber Co., Lockport, N. Y., are introducing a cheese cover, as illustrated herewith. It is referred to as adding to the appearance of the counter,

Indurated Fiber Cheese Cover.

and as being both light and strong. The points are made that it will keep cheese from drying up; also that it will not break if jarred on the counter, as glass covers often do.

Car Box Jack Screw.

The Illinois Iron and Bolt Company, Carpentersville, Ill., are putting on the

Car Box Jack Screw.

market car box jack screws, as illustrated herewith. These jack screws are made with swivel caps of the same diameter as

the head, closed at the top to prevent dirt from entering between the cap and screw. The cap is held in place by a set screw running in a groove cut in the top of the screw.

The Whitney Safety Hammerless Shot Gun.

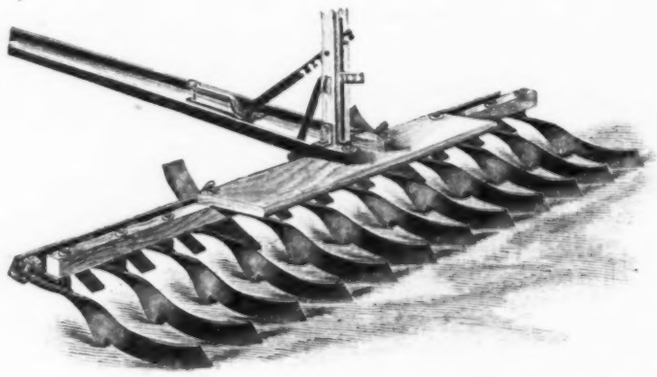
The Whitney Safety Fire Arms Company, Florence, Mass., are introducing a hammerless shot gun, as illustrated in Figs. 1 and 2. Referring to Fig. 2, it will be seen that the opening and closing of the barrels has nothing to do with the cocking of the gun. The hammers are always in the position shown in the cut except at the moment of firing, but the main spring, however, has no tension whatever on it until the tension lever A is pressed home by the shooter's hand when the gun is brought to the shoulder. Upon releasing the lever after firing, the hammers automatically resume the position shown in cut and remain there until the lever is again pressed home and the trigger pulled. This gun is presented as a hammerless gun which will be absolutely safe, well made, a good shooter, at such a cost as to place it within reach of all sportsmen. The working parts of the gun are referred to as being made from the very best steel forgings, the parts few and strong. The opening or closing of the gun has nothing whatever to do with the cocking. It is stated that particular attention has been paid to getting a nice, symmetrical and well balanced gun; and that the shooting qualities of the guns will receive special attention, and all of their guns will be bored to use wads the same bore as the gun. The manufacturers guarantee their work in all particulars.

Fig. 1.—The Whitney Safety Hammerless Shot Gun.

Fig. 2.—Safety Hammerless Shot Gun, Showing the Working Parts.

New Style Acme Harrow.

Duane H. Nash, Millington, N. J., is introducing a new style Acme Pulverizing Harrow, Clod Crusher and Leveler, as illustrated herewith. The leveling bar and clod crusher is adjustable and consists of a strong bar of angle iron, to which is attached cast steel crushing bars, the alternate ones being extended and curved in such a manner as to form colters. Attention is directed to the peculiar form of the cast steel colter teeth, being curved and beveled to a sharp edge and polished; also to the manner of their attachment to the implement. These are so made and arranged as to secure a right and left, intersecting, uplifting under cut, to insure the cutting over of the entire surface of the ground, and at the same time to lift and turn the soil. The standing board or platform is designed for the driver to ride upon, and the level within his reach enables the operator to control the position of the crusher; also to raise or depress the colters to regulate the depth of the work. The harrow is provided with a pair of runners as a substitute for a sulky attachment, which are intended to regulate the depth of the work and for transporting the implement on the road. Emphasis is placed upon the fact that the great reduction in price of the new style harrow brings it within the reach of all farmers.

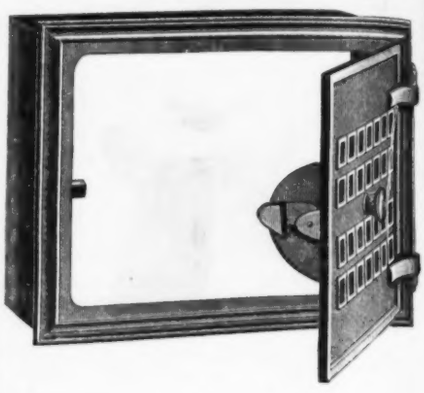


New Style Acme Pulverizing Harrow, Clod Crusher and Leveler.

The engineering works which indicate the future greatness of New York are the projected New Jersey bridge, the North River tunnel, on which work is in progress, the proposed Forty-second street tunnel under the East River, the proposed Henning gravity tunnel under the same river at Grand street, and Erastus Wiman's proposed New York Bay tunnel to Staten Island.

Self Locking Coal Shute.

The Joseph Bell Stove Company, of Wheeling, W. Va., are manufacturing what they are pleased to call a Burglar Proof Self Locking Coal Shute, an engraving of which is presented in the accompanying illustrations. This device consists of a heavy hopper and frame cast in one piece, for the purpose of building it into the basement walls. As will be seen from an inspection of the cut, it is provided with a heavy door, furnished with a register for ventilation and light. The special features to which the manufacturers direct attention are the means for self locking and protection from intrusion from without. The former result is reached by means of a heavy hook, which is so arranged that it cannot drop below a given angle, and which is firmly secured between a shield and lug in such a way as to permit freedom of movement. A wrought lug is cast into the hopper, and when the door is pushed shut the hook locks over the lug automatically. The shield prevents any tampering with the fastening from without. Still another advantage of this shute is found in the fact that, after throwing in the coal, the teamster can close the door, thus avoiding the necessity of going through the cellar and climbing over the pile of coal in order to secure the door in place. The arrangement of parts is such that the shute may be opened in the usual manner from within.

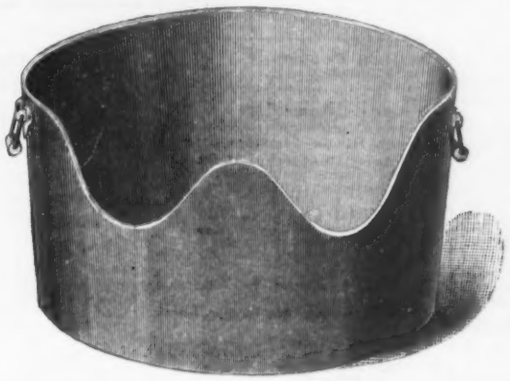


Burglar Proof Self Locking Coal Chute

Sir James Kitson, of England, remarks that the industrial condition of Great Britain is now remarkably prosperous, but they "hope to gain much from the labor saving appliances, which are more developed in American works than in British, owing to the fact that American labor is so much higher priced than ours, and the necessity of labor saving machinery has forced itself upon our friends on this side of the Atlantic more than with us, with labor at our lower rate."

Indurated Fiber Sitz Tubs.

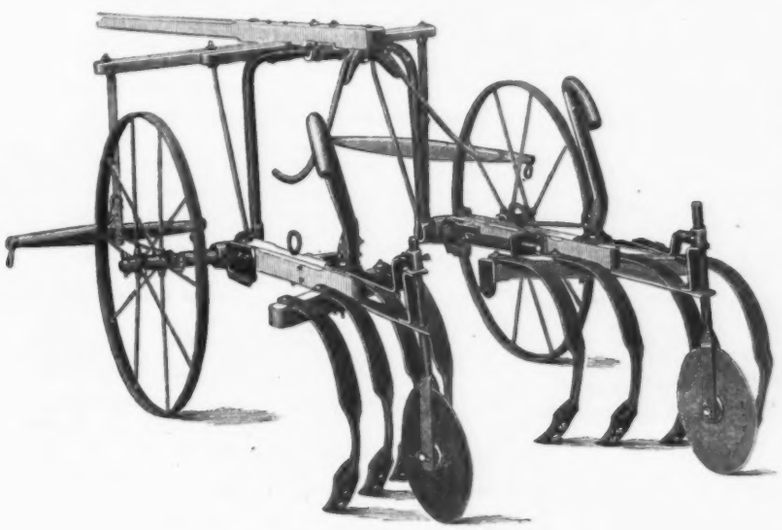
The United Indurated Fiber Company, Lockport, N. Y. are introducing a sitz tube, as illustrated herewith. This is referred to as meeting the requirements of the case, and having the same qualifications as other water containing articles manufactured from this material.



Indurated Fiber Sitz Tubs.

The Success Walking Cultivator.

The Springfield Implement Company, Springfield, Ohio, are introducing a walking cultivator, known as A. W. B.'s Success, shown in the accompanying illustration. The handles are pivoted to the rear end of the beams, and connected to an arm on the tiller or yoke of the rolling coulters or deflectors, to cause the guiding attachment or deflectors to move in or out or operate with the handles. It is stated that the moment the handles are moved to or from the corn the beams and teeth are instantly moved in the right direction, whereby the teeth on the cultivator are moved to or from the corn instantaneously without lifting them out of the ground, on the same principle that a ship is guided in the water. The teeth are set in an A shape on both beams, which is considered the best position they can be put in, to clear and relieve themselves of trash, as corn stalks, weeds, &c., are carried out, and the point is made that it is almost an impossibility to choke the machine. The shape, angle, and pitch of the teeth are designed to insure their running into and cultivating the ground in the most effective manner. The beam couplings are referred to as being new and an ingenious feature, being readily adjusted to run the teeth near to or further from the corn, as desired. The beam springs act direct on the center of the axle. The pressure either up or down is regulated on both beams at the same time, either a very small or large adjustment is made, as desired, or the position of the front ends of the beams, or the position of the springs, can be varied by raising or lowering the front end of the tongue. The beam spring is attached along the inside of the beam, and the pressure is directly on the horizontal part of the axle, which arrangement is intended to do away with the objectionable feature of throwing the tongue up and down. Attention is directed to the arch box on the tongue so arranged as to raise or lower the points of the beams; also to the arch braces which are so arranged that the axle can be drawn forward or back to diminish or increase the upward or downward pressure of the spring. The foregoing limited description will enable the reader to form an idea of the desirable features of the machine. These cultivators are furnished with either three teeth on each side, making a six tooth cultivator, or four teeth on a side, making an eight tooth cultivator.



The Success Walking Cultivator.

Business Prospects in Canada.

Business failures in Canada for nine months of the present year are in excess, compared with several years past. The number is 1376 and the liabilities are put down at $13,700,000, so that the fair harvest of 1890, it is remarked, "came none to soon." Respecting prospects, the Montreal *Gazette* says:

The policy of bankers and wholesalers has been for a long time against anything approaching an undue extension of credits. This has, of course, not been without its effect on the situation. There will this year be a surplus of wheat for export, with the promise at present of better prices than have been received for some time, the returns from which will soon be visible. In live stock and cheese, now the chief elements in our agricultural exports, the shipments to date have been ahead of the record and show every indication of keeping up. The lumber trades depression, judging by the confidence shown in the purchase of limits at the recent Ontario Government sale, is not expected to last long. These are the favorable elements in the situation. On the other hand, the operation of the McKinley tariff is looked upon in some quarters as a serious evil. It is as yet, however, as regards its permanent effects, an unknown quantity, and not till next year will its influence on Canadian trade be accurately judged of.

CONTENTS.

CURRENT HARDWARE PRICES.

OCTOBER 15, 1890.

Note.—The quotations given below represent the Current Hardware Prices which prevail in the market at large. They are not given as manufacturers' prices, and manufacturers should not be held responsible for them. In cases where goods are quoted at lower figures than the manufacturers name, it is not stated that the manufacturers are selling at the prices quoted, but simply that the goods are being sold, perhaps by the manufacturers, perhaps by the jobbers at the figures named.

Adjusters, Blind.
Domestic.....₩ doz $3.00, 33⅓%
Excelsior.....₩ doz $10.00.....50&10&2%
Washburn's Self-Locking.....20@20&10%

Ammunition.—
Caps, Percussion, ₩ 1000—
Hicks & Goldmark's and Union Metallic Cartridge Co.
F. L. Waterproof, 1-10's.....84@35¢
E. B. Trimmed Edge, 1-10's.....46@48¢
E. B. Grnd. Edge, Cent. Fire, 1-10's.....46@47¢
Musket Waterproof, 1-10's.....50¢
G. D.....28¢
S. B. Genuine Imported.....45¢
Eley's E. B.....54¢ @ 55¢
Eley's D Waterproof, Central Fire...$1.60
Cartridges—
Rim Fire Cartridges.....50&5&2 %
Rim Fire Military.....15&2 %
Cent. Fire, Pistol and Rifle.....25&5&2 %
Cent. Fire, Military and Sporting.....15&5&2 %
Blank Cartridges, except 22 and 32 cal., additional 10 % on above discounts.
Blank Cartridges, 22 cal., $1.75.....2 %
Blank Cartridges, 32 cal., $3.50.....2 %
Primed Shells and Bullets.....15&5&2 %
B. B. Caps, Round Ball, $1.75.....2 %
B. B. Caps, Con. Ball, Swgd., $3.00.....2%
Primers—
erdan Primers, $1.00.....2%
B. L. Caps (for Sturtevant Shells) $1.00, 2%
All other Primers, $1.20.....2%
Shells—
First quality 4, 8, 10 and 12 gauge.....25&10&2%
First quality, 14, 16 and 20 gauge ($10 list).....30&10&2%
Prize.....40&2%
Star, Club, Rival and Climax brands, 33⅓&10&2%
Selbold's Comb. Shot Shells.....15&2%
Brass Shot Shells, 1st quality.....60&2%
Brass Shot Shells, Club, Rival, Climax.....65&2%
Shells Loaded—
Standard List, July 19, 1890..40&10&5%
Wads—Price per M.
U.M.C.&W. R. A.—B. E., 11 up... 68¢
U.M.C.&W. R. A.—B. E., 9&10... 82¢
U.M.C.&W. R. A.—B. E., 8..... 96¢
U.M.C.&W.R. A.—B. E., 7.....$1.10
U.M.C.&W. R. A.—P. E., 11 up.. 1.15
U.M.C.&W. R. A.—P. E., 9&10.. 1.50
U.M.C.&W. R. A.—P. E., 8..... 1.70
U.M.C.&W.R. A.—P. E., 7..... 1.80
Dis.20&2
Eley's B. E., 11 up.....$1.75
Eley's P. E., 11@20.....2.80

Anvils.—
Eagle Anvils, ₩ ℔ 10¢.....15@15&5%
Peter Wright's.....11½¢
Armitage's Mouse Hole.....10½¢
Armitage's Mouse Hole, Extra...12@12½¢
Trenton.....9½@10¢
Wilkinson's.....9½@10¢
Moore & Barnes Mfg. Co.....33⅓%
Anvil Vise and Drill—
Millers Falls Co., $18.00.....20%
Cheney Anvil and Vise.....25%
Allen Anvil and Vise, $3.00.....40&10%
Star.....45&5 %

Apple Parers—See Parers. Apple, &c.

Augers and Bits—
Douglass Mfg. Co.
Wm. A. Ives & Co.
Humphreysville Mfg. Co.
French, Swift & Co. (F. H. Beecher,...
P. S. & W. Co.
Rockford Bit Company
Cook's, Douglass Mfg. Co.
70&10%
Cook's, N. H. Copper Co.50&10&50&10&5%
Ives' Circular Lip.....60%
Patent Solid Head.....30%
C. E. Jenning & Co., No. 10, extension lip.....40%
C. E. Jennings & Co., No. 30.....60%
C. E. Jennings & Co., Auger Bits, ₩ set, 32⅔ quarters, No. 5, $6; No. 30, $3.50.20%
Lewis' Patent Single Twist.....45%
Russell Jennings' Augers and Bits.25&10%
Imitation Jennings' Bits.....60@60&5%
Snell's Jennings Pattern.....60%
Pugh's Black.....60%
Rockford, Jenning's Pattern.....20%
Car Bits.....60%
Car Bits, P. S. & W. Co.....60@60&10%
Snell's Car Bits.....60%
L Hommodieu Car Bits.....60&10%
Forstner Pat. Auger Bits.....15&10%
Cincinnati Bell-Hangers' Bits....30&10%
Bit Stock Drills—
Morse Twist Drills.....50&10&5%
Standard.....50&10&5%
Cleveland.....50&10&5%
Syracuse, for metal.....50&10%
Syracuse, for wood (wood list).30@30&5%
Williams' or Holt's, for metal.50&10&10%
Williams' or Holt's, for wood...40&10%
Cincinnati, for wood.....30&10%
Cincinnati, for metal.....45&10%
Expansive Bits—
Clarks' small, $18; large, $26 ₩ doz.35@35&5%
Ives' No. 4, ₩ doz $60.....40%
Swan's.....40%
Steer's, No. 1, $25; No. 2, $22.....35%
Stearns' No. 2, $48.....20%
Gimlet Bits—
Common.....₩ gross $2.75@$3.25
Diamond.....₩ doz $1.10.....25&10%
Bee.....25@25&5%
Double Cut, Shepardson's.....45@4[illegible]&10%
Double Cut, Ct. Valley Mfg. Co ...30&10%
Double Cut, Hartwell's, ₩ gro.....$5.25
Double Cut, Douglass'.....40&10%
Double Cut, Ives'.....60@60&10%
Hollow Augers—
Ives
French, Swift & Co.
Douglass'
33⅓ @ 33⅓&10%
Bonney's Adjustable, ₩ doz $48....40&10%
Stearns'.....20&10%
Ives' Expansive, each $4.50.....50&5%
Universal Expansive, each $4.50.....20%
Wood's.....25@25&10%
Cincinnati Adjustable.....25&10%
Cincinnati Standard.....25&10%
Ship Augers and Bits—
L'Hommedieu's.....15&10@15&10&5%
Watrous'.....15&10@15&10&10%
Snell's.....15&10@15&10&5%
Snell's Ship Auger Patt'n Car Bits, 15&10@15&10@5%

Awl Hafts—See Hafts, Awl.

Awls, Brad Sets, &c—
Awls, Sewing, Common ₩ gr $1.70, 35%
Awls, Should. Peg. ₩ gr $2.45, 40@40&10%
Awls, Pat. Peg...₩ gr 63¢.... 40@40&10%
Awls, Shouldered Brad...2.70 ₩ gr.....35%
Awls, Handled Brad...$7.50 ₩ gr.....45%
Awls, Handled Scratch ₩ gr, $7.50.35&10%
Awls, Socket Scratch, ₩ doz, $1.50.25@30%

Awl and Tool Sets—See Sets, Awl and Tool.

Axes—

	Plain.	Beveled.
First quality	$8.00	$8.50
Others	7.50	8.00

Axle Grease—See Grease, Axle.

Axles—
No. 1,4¼@5¢, No. 2 5½@6¼¢ } 3 % cash
Nos. 7 to 14.....55&5%
Nos. 15 to 18.....47½%
Nos. 19 to 22.....70%
Concord Axles, loose collar.....5¢@6¢
Concord Axles, solid collar.....6¢@7¢
National Tubular Self-Oiling..... 33⅓&10@33⅓&5%

Bag Holders.—See Holders, Bag.

Balances—
Spring Balances.....40%

No.	2000	20	90
Chatillon, ₩ doz	$0.80	0.95	1.75 net

Chatillon Straight Balances.....40%
Chatillon Circular Balances.....50&10%

Bars.
Crow—
Cast Steel.....₩ ℔ 4¼¢
Iron, Steel Points.....₩ ℔ 3½¢

Basins, Wash—
Standard Fiberware, No. 1, 10½-inch, $2; 12-inch, $2.25; 13½-inch, $2.75; 15-inch, $3.25.

Beams, Scale—
Scale Beams, List Jan. 12, '82...50&10@50&10&5%
Chatillon's No. 1.....40%
Chatillon's No. 2.....50%
Custer's.....33⅓%

Beaters, Egg, &c—
Keystone, P.D.&C., Each, No. 1, $1; No. 2, $2.....20 %
Dover.....₩ doz $1.50
Duplex (Standard Co.).....₩ doz $1.25
Rival (Standard Co.).....₩ doz $1.00
Duplex Extra Heavy (Standard Co.)...₩ doz $3.50
Bryant's.....₩ gro $14.00
Double (H. & R. Mfg. Co.), ₩ gro. No. 0, $12.00; No. 1, $15.00; No. 2.....$36.00
Easy (H. & R. Mfg. Co.).....₩ gro $12.00
Triple (H. & R. Mfg. Co.).....₩ gro $16.50
Spiral (H. & R. Mfg. Co.).....₩ gro $4.50
Improved Acme (H. & R. Mfg. Co.).....₩ gro $9.00
Paine. Diehl & Co.'s.....₩ gro $24.00
Silver & Co.....₩ doz $5.50

Bells—
Cow—
Common Wrought.....60&10%
Western.....20&10%
Western, Sargent's list.....70&10%
Kentucky, "Star".....20&10%
Kentucky, Sargent's list.....70&10%
Dodge, Genuine Kentucky....70@70&10%
Texas Star.....50&10@50&10&5%
Call.....40@40&5%
Farm Bells.....₩ ℔ 3¢@3½¢
Steel Alloy Church and School Bells..40%
Door—
Gong, Abbe's.....33⅓&10%
Gong, Yankee.....45&10%
Gong, Barton's.....40&10@50%
Crank, Taylor's.....25&10%
Crank Brooks'.....50&10&2%
Crank Cone's.....10%
Crank, Connel's.....20&10%
Lever, Sargent's.....60&10%
Lever, Taylor's Bronzed or Plated....net
Lever, Taylor's Japanned.....25&10%
Lever, R. E. M. Co.'s.....50&10&2%
Pull, Brook's.....50&10&2%
Pull, Western.....25&10%
Electric,
Wollensak's.....20%
Bigelow & Dowse.....20%
Taylor's.....20%
Hand—
Light Brass.....75&10%
Extra Heavy.....65&10%
White Metal.....60&10&10%
Silver Chime.....33⅓&10%
Globe(Cone's Patent).....25&10@35%

Bellows—
Blacksmiths'.....60&5@65%
Molders'.....40@40&10%
Hand Bellows.....40&10&50%

Belting, Rubber—
Common Standard.....70@70&5%
Standard.....60&10&10@70%
Extra.....50&10@60%
N.Y.B.&P.Co., Carbon...50&5@50&10&5%
N.Y.B.&P.Co., Diamond....40&5@40&10%

Bench Stops—See Stops, Bench.

Benders, Upsetters, Tire.
Stoddard's Lightning Tire Upsetters..15%
Detroit Perfected Tire Bender.....15%

Bits—
Auger, Gimlet, Bit Stock, Drills, &c., see Augers and Bits.

Bit Holders—See Holders.

Blind Adjusters—See Adjusters, Blind.

Blind Fasteners—See Fasteners, Blind.

Blind Staples—See Staples, Blind.

Blocks—
Ordinary Tackle, list May 20, 1889... See Trade Report.
Cleveland Block Co., Mal. Iron.....50%
Moore's Novelty, Mal. Iron.....50%

Boards, Stove.
Wood Lined "Crystal".....50%
"Embossed".....50%
"Oxidized".....45%
Paper Lined Zinc.....55%
"Crystal".....55%
"Embossed".....55%
"Oxidized".....45%

Bolts—
Carriage, Machine, &c.—
Com. list June 10, '84.....70&10&5&2%
Genuine Eagle, list Oct., '84...75&10@80%
Phila. pattern, list Oct. 7, '84..80@80&10%
R.B.&W., old list.....70%
Machine, list Jan. 1, 1890.....75&10@75&10&5%
Bolt Ends, list Jan. 1, 1890.....75&10@75&10&5%
Door and Shutter—
Cast Iron Barrel, Square, &c..70@70&10%
Cast Iron Shutter Bolts.....70@70&10%
Cast Iron Chain (Sargent's list)....65&10%
Ives' Patent Door Bolts.....60%
Wrought Barrel.....70@70&10%
Wrought Square.....70@70&10%
Wr't Shutter, all Iron, Stanley's..60&10%
Wr't Shutter, Brass Knob, " ..40&10%
Wr't Shutter, Sargent's list.....60&10%
Wr't Sunk Flush, Sargent's list...55&10%
Wr't Sunk Flush, Stanley's list...50&10%
Wr't B.K.Flush. Com'n " ...55&10%
Stove and Plow—
Stove.....60%
Plow.....60&5%
R. B. & W., Plow.....55%
Tire—
Common, list Feb. 28, '83.....65%
Port Chester Bolt and Nut Company:
Empire, list Feb 28, '83.....65%
Keystone, Philadel., list Oct. '84...80%
Norway, Phila., list Oct. '84.....75%
American Screw Company:
Norway, Phil., list Oct. 16, '84.....75%
Eagle, Phil., list Oct. 16, '84.....80%
Philadel., list Oct. 16, '84.....80%
Bay State, list Feb. 28, '83.....65%
R.B.&W., Philadel., list Oct. 16, '84.....80%

Borers, Tap.
Common and Rind.....20&10%
Ive's Tap Borers.....33⅓&5%
Enterprise Mfg. Co.....20&10&30%
Clark's.....33⅓@35%

Borax—₩ ℔ 9½@10½¢

Boring Machines—See Machines, Boring.

Bow Pins—See Pins, Bow.

Boxes, Wagon.
Per ℔.....2¾¢

Braces.—
American Bit Brace Co.:
Nos. 10, 12, 20.....60&10%
Nos. 11, 21, 24, 27.....70&10%
Nos. 22, 23, 25.....60&10&5%
Nos. 13, 26, 36, 37.....70&10&5%
Ball Braces, net.....$1.12 to $1.25
Amidon's
Barker's Imp'd Plain.....75&10@80%
Barker's Imp. Nickeled.....65&10@70%
Ratchet.....75&10@80%
Eclipse Rachet.....60%
Globe Jawed.....40@40&10%
Corner Brace.....40@40&10%
Universal, 8 in., $2.10 10 in.....$2.25
Buffalo Ball.....$1.10@$1.15
Barber's,
Nos. 10 to 16.....50%
Nos. 30 to 33.....50%
Nos. 40 to 63.....50&10%
Saxton's,
Barker's Imp. Polished.....75&10@80%
Barker's Imp. Nickeled.....65&10@70%
Ratchet, Polished.....50&10@60%
Ratchet, Nickeled.....40&10@50%
Buffalo Ball.....net, $1.10@$1.15
Bartholomew's,
Nos. 25, 27 and 30.....50&10@60&5%
Nos. 117, 118, 119.....70@70&5%
Common Ball, American.....$1.00@$1.10
Fray's Genuine Spofford's..50&5&50&10%
Fray's No. 70 to 120, 81 to 123, 207 to 414 50&10%
Ives' New Haven Novelty.....70@70&5%
New Haven Ratchet.....60&5@60&10%
Barber Ratchet.....60&5@60&10%
Barbers.....60&5%
Spofford.....60&5@60&10%
Osgood's Ratchet.....40&10@50%
P. S. & W. Co., Peck's Patent.....60%

Brackets—
Shelf plain, Sargent's list, 55&10@55&10&10%
Shelf, fancy, Sargent's list, 60&10@60&10&10%
Reading, plain.....50&10@60&10&5%
Reading, Rosette.....60&10@60&10&10%

Bright Wire Goods—See Wire.

Broilers—

Henis' Self-Basting.	Inch.....	9	10	9x11
	Per doz .	$4.50	5.50	6.50

New Haven.....50%

Buckets, Well.
Galvanized—
Hill's.....₩ doz, 12 qt, $4.25; 14 qt, $5.25
Iron Clad.....₩ doz. 14 qt, $4.25@$4.50
Helwig's Flat Iron Band.....$4.25@4.50
Helwig's Wired Top....₩ doz $4.00@4.25

Bull Rings—See Rings, Bull.

Butcher's Cleavers—See Cleavers Butchers'.

Butts—
Brass—
Wrought Brass.....75&10@80%
Cast Brass, Tiebout's.....50%
Cast Brass, Corbin's, Fast.....33⅓&10%
Cast Brass, Loose Joint.....33⅓&10%
Cast Iron—
Fast Joint, Narrow.....50&10&5@60%
Fast Joint, Broad.....50&10@60%
Loose Joint.
Loose Joint, Japanned.
Loose Joint, Jap. with Acorns..
Parliament Butts.
Mayer's Hinges.
Loose Pin, Acorns.
Loose Pin, Acorns, Japanned...
Loose Pin, Acorns, Japanned, Plated Tips.
70&10@ 70&10%
Wrought Steel—
Fast Joint, Narrow.
Fast Joint, Lt. Narrow.
Fast Joint, Broad.
Loose Joint, Broad.
Table Butts, Back Flaps, &c.....
Inside Blind, Regular.
Inside Blind, Light.
Loose Pin.
70&10%
Bronzed Wrought Butts.....50

Calipers—See Compasses.

Calks, Toe—
Gautier.....₩ ℔ 5½@6¢
Dewicks (Burke).....₩ ℔ 5½@6¢

Can Openers—See Openers, Can.

Cards—
Horse & Curry.....10&10&10&10%
Cotton.....10&10&10%
Wool.....10&10&10%

Carpet Stretchers—See Stretchers Carpet.

Carpet Sweepers—See Sw Carpet.

Cartridges—See Ammunition.

Casters—
Bed.....
Plate.....
Shallow Socket.....
Brass....55@55&10%
Others...60@60&10%
Deep Socket.....40&10%
Yale Casters, list May, 1884...30&10@40%
Yale, Gem.....60@60&5%
Martin's Patent (Phœnix).....45&10@50%
Payson's Anti-friction.....60@60&10%
Giant Truck Casters.....30%
Stationary Truck Casters.....50&10%
Socket Truck Casters.....50%

Cattle Leaders—See Leaders, Cattle.

Chain—
Trace, Wagon and Fancy Chains, List revised April 21, 1890.....50& 10@60%

American Coil, in cask lots,	3-16	¼	5-16	⅜	7-16	½	⅝	¾
	$7.75	5.45	4.55	4.00	3.65	3.50	3.40	3.30

Less than cask lots, add ½¢@1½¢ ℔.
German Coil, list of June 20, 1887 50&10&5@60%
German Halter Chain, list of June 20, 1887.....50&10&5@60%
Covert Halter.....60&2%
Covert Traces.....35@3%
Covert Heel Chain.....50&2%
Oneida Halter Chain.....60@60&2%
Galvanized Pump Chain.....₩ ℔ 5½@6¢
Jack Chain, Iron.....75&10@80%
Jack Chain, Brass.....75@75&10%

Chalk—
White.....₩ gr 50¢
Red.....₩ gr 70¢
Blue.....₩ gr 85¢
See also Crayons.

Chalk Lines—See Lines.

Chisels—
Socket Framing and Firmer.
P. S. & W.
New Haven.
Witherby.
Mix.
Ohio Tool Co.
..75 @ 75&10
Douglass.....75@75&5%
Buck Bros.....30%
Merrill.....60&10@60&10&5%
L. & I. J. White.....30@30&5%
Tanged and Miscellaneous.
Tanged Firmers.....40&10@50%
Butchers'.....$4.75@$5.00
Spear & Jackson's.....$5 to $
Buck Bros.....30%
Cold Chisels, ₩ ℔.....15@16%

Chucks—

Beach Pat.....each, $8.00.....20%
Morse's Adjustable,each, $7.00, 20@20&5%
Danbury.....each, $6.00, 30@30&5%
Syracuse, Bals Pat.....25%
Skinner's Patent Chucks.
Combination Lathe Chucks.....33⅓&5
Universal Lathe Chucks.....40%
Independent Lathe Chucks.....40%
Drill Chucks.....15%
Union Mfg. Co.,
Victor.....$8.50, 25%
Combination.....40%
Universal.....40%
Independent.....40%

Churns.

Tiffin Union No. 1, 5 gallon...$3.25 each
Tiffin Union No. 2, 7 gallon...$3.75 each
Tiffin Union No. 3, 10 gallon...$4.25 each

Clamps—

R. I. Tool Co.'s Wrought Iron.....25%
Adjustable, Cincinnati.....15&10%
Adjustable, Hammers.....15%
Adjustable, Stearn's.....30@30&10%
Stearn's Adjustable Cabinet and Corner.....30@30&10%
Cabinet, Sargent's.....60&10%
Carriage Makers', Sargent's.....70&10%
Carriage Makers', P., S. & W. Co..40&10%
Eberhard Mfg. Co.....40&5@40&10%
Warner's.....40&10@40&10&5%
Saw Clamps, see Vises, Saw Filers'.
Carpenters', Cincinnati).....25&10%

Cleavers.

Butchers'.

Bradley's.....25@30%
L. & I. J. White.....20&5%
Beatty's.....40@40&5%
New Haven Edge Tool Co.'s.....40%
P., S. & W.....33⅓&5@33⅓&10%
Foster Bros.....30@40%
Schulte, Lohoff & Co.....40@40&5%

Clips—

Norway, Axle, ¼ & 5-16.....55&5&5%
2nd grade Norway Axle, ¼ & 5-16. 65&5%
Superior Axle Clips.....60%&5&70%
Norway Spring Bar Clips, 5-16..60&5&5%
Wrought-Iron Felloe Clips.....₩ lb, 5¢
Steel Felloe Clips.....₩ lb, 5¢
Baker Axle Clips.....25%

Cloth and Netting, Wire—See Wire, &c.

Cockeyes.....50%

Cocks, Brass.

Hardware list.....50&2%

Coffee Mills—See Mills, Coffee.

Collars, Dog, &c.

Medford Fancy Goods Co.....40&10%
Embossed, Gilt, Pope & Steven's list 30&10%
Leather, Pope & Steven's list.....40%
Brass, Pope & Steven's list.....40%
Chapman Mfg. Company....50&10@60%

Combs, Curry.

Fitch's.....50&10@50&10&10%
Rubber, per doz $10.00.....20%
Perfect.....50%

Compasses, Dividers, &c.—

Compasses, Calipers, Dividers.70@70&10%
Bemis & Call Co.'s
Dividers.....60&5%
Compasses & Calipers.....50&5%
Wing and Inside or Outside.....50&5%
Double.....60%
(Call's Pat. Inside).....30%
Excelsior.....50%
J. Stevens & Co.'s.....25&10%
Starrett's
Spring Calipers and Dividers....25&10%
Lock Calipers and Dividers.....25%
Combination Dividers.....25%

Coopers' Tools—See Tools, Coopers'.

Cord, Sash—

Common.....₩ lb 10@11¢
Patent, good quality.....₩ lb 13@13½¢
White Cotton Braided, fair...₩ lb 28@29¢
Common Russia Sash.....₩ lb 13½¢
Patent " " .....₩ lb 15¢
Cable Laid Italian Sash.....₩ lb 22@23¢
Indian Cable Laid " .....₩ lb 13¢
Silver Lake—
A Quality, White, 50¢.....10&10&5%
A Quality, Drab, 55¢.....10&10&5%
B Quality, White, 50¢.....28@40%
B Quality, Drab, 55¢.....31@33%
C Quality, White (only).....26@27¢
Sylvan Spring, Extra Braided, White, 34¢
Sylvan Spring, Extra Braided, Drab..39¢
Semper Idem, Braided, White.....30¢
Egyptian, India Hemp, Braided.....25¢
Samson—
Braided, White Cotton, 50¢...30@30&5%
Braided, Drab Cotton, 55¢....30@30&5%
Braided, Italian Hemp, 55¢...30@30&5%
Braided, Linen, 80¢.....30@30&5%

Corkscrews—See Screws, Cork.

Corn Knives and Cutters—See Knives, Corn.

Crackers, Nut—

Table (H. & B. Mfg. Co.).....40%
Blake's Pattern.....₩ doz $2.00, 10%
Turner & Seymour Mfg. Co.....50%

Cradles—

Grain.....50&5&2@50&10&2%

Crayons.

White Crayons, ₩ gr, 12¢@12½¢.....10%
D. M. Steward Mfg. Co., Metal Workers, ₩ gr, $2.50.....25%
M. Steward Mfg. Co., Rolling Mill, ₩ gr, $2.50.....25%
See also Chalk.

Crow Bars—See Bars, Crow.

Curry Combs—See Combs, Curry.

Curtain Pins—See Pins, Curtain.

Cutters—

Meat.

Dixon's ₩ doz.....40&5%

Nos.	1	2	3	4
	$14.00	$17.00	$19.00	$20.00

Woodruff's ₩ doz.....40&5%

Nos.		100	150
		$15.00	$18.00

Hales Pattern ₩ doz.....70@70&5%

Nos.	11	12	13
	$27.00	$33.00	$45.00

American.....30%

Nos.	1	2	3	4	B	5
Each	$5	$7	$10	$25	$50	$60

Enterprise.....30%

Nos.	10	12	22	32	42
Each	$2	$2.50	$4	$6	$15

Great American Meat Cutter.....30%

Nos.	112	116	118	120	122
Each	$2.00	$2.75	$3.00	$2.50	$4.00

Miles' Challenge ₩ doz.....45@45&10%

Nos.	1	2	3
	$22.00	$30.00	$40.00

Home No. 1.....₩ doz, $26.00, 55&10%
Draw Cut, each:

Nos.	5	2	6	8
	$50	$75	$80	$225

.....30@25%
Great American.....60%
Beef Shavers (Enterprise).....20&10@30%
Little Giant.....50%
Chadborn's Smoked Beef Cutter, ₩ doz $36.00

Tobacco.

Champion.....20&10@30%
Wood Bottom.....₩ doz $5.00@$5.25
All Iron.....₩ doz $4.25
Nashua Lock Co.'s..₩ doz, $18.00 50@55%
Wilson's.....50%
Sargents's.....₩ doz, $24, 55&10%
Acme.....₩ doz $20.00, 40%

Washer.

Smith's Pat.....₩ doz $12.00, 20&10&10%
Johnson's.....₩ doz $11.00, 33⅓%
Penny's, ₩ doz Pol. $14; Jap'd, $16.00, 55%
Appleton's.....₩ doz $16.00, 60&10%
Bonney's.....30&10%
Cincinnati.....25&10%

Cutlery—

Beaver Falls & Booth's.....33⅓
Wostenholme.....$7.75 to $

Dampers, &c—

Dampers, Buffalo.....40&10%
Buffalo Damper Clips.....40&10%
Crown Damper.....40%
Excelsior.....40&10%

Diggers, Post Hole, &c.—

Samson Post Hole Digger, ₩ doz $36.00, 25%
Fletcher Post Hole Augers, ₩ doz $36, 20%
Eureka Diggers.....₩ doz $12.50@14.00
Leed's.....₩ doz $8.00@9.00
Vaughan's Post Hole Auger, ₩ doz $13.00@14.00
Kohler's Little Giant.....₩ doz. $18.00
Kohler's Hercules.....₩ doz. 15.00
Kohler' New Champion.....₩ doz. $9.00
Schniedler.....₩ doz. $18.00
Ryan's Post Hole Diggers..₩ doz $24.00
Cronk's Post Bars, ₩ doz $40.00, 50&5&50&10%
Gibbs Post Hole Digger, ₩ doz $30.00, 50¢
Imperial, ₩ doz $15.....45%

Dividers—

See Compasses.

Dog Collars—See Collars, Dog, &c.

Door Springs—See Springs, Door.

Drawers.

Money, ₩ doz.....$18@$20

Drawing Knives—See Knives, Drawing.

Drills and Drill Stocks—

Blacksmiths'.....each $1.75
Blacksmiths' Self-Feeding, each $7.50,20%
Breast, P. S. & W.....40&10%
Breast, Wilson's.....30&5%
Breast, Millers Falls.....each $3.00, 25%
Breast, Bartholomew's....each $2.50, 25&10&40%
Ratchet, Merrill's.....20@20&5%
Ratchet, Ingersoll's.....25%
Ratchet, Parker's.....20@20&5
Ratchet, Whitney's.....20&10%
Ratchet, Weston's.....20@25%
Ratchet, Moore's Triple Action...25@30%
Ratchet, Curtis & Curtis.....30%
Whitney's Hand Drill, Plain, $11.00; Adjustable, $12.00.....20&10%
Wilson's Drill Stocks.....10%
Automatic Boring Tools.....$1.75@$1.85

Twist Drills—

Morse.....50&10&5%
Standard.....50&1. &5%
Syracuse (Metal list).....50&10%
Cleveland.....50&10&5%
Williams.....50&10&10%
New Process.....50&10&5%

Drill Bits.—See Augers and Bits.

Drill Chucks.—See Chucks.

Dripping Pans-See Pans, Dripping.

Drivers, Screw.

Douglas Mfg. Co.....20@20&10%
Disston's.....60%
Buck Bros.....30%
Stanley R. & L. Co.'s
Varnished Handles.....65&10%
Black Handles.....60&10%
Sargent & Co.'s
No. 1 Forged Blade.....60&10&10%
Nos. 20, 30 and 60.....60%&10&10%
P. S. & W.....70%
Knapp & Cowles No.1.....60&10&70%
No. 1 Extra.....60@60&10
Nos. 00 & 4.....50&5@&10&5%
Stearns'.....25&10&5%
Gay & Parsons.....35%
Champion.....25&10%
Clark's Pat.....30@33⅓%
Crawford's Adjustable.....30%
Ellrich's Socket and Ratchet..25@35&10%
Allard's Spiral, new list.....25%
Kolb's Common Sense ₩ doz $6.00,25&10%
Syracuse Screw-Driver Bits....30@30&5%
Screw-Driver Bits .....₩ doz. 50@75¢
Screw-Driver Bits, Parr's.....₩ gro $6.25
Fray's Hol. Hdle. Sets, No. 3, $12.00, 25@25&10%
P. D. & Co.'s all Steel.....50%
Cincinnati.....25&10%
Brace Screw Drivers.....25&10%
Buck Bros.' Screw-Driver Bits.....%

Egg Beaters.—See Beaters, Egg.

Egg Poachers.—See Poachers, Egg.

Electric Bell Sets.—See Bells, Electric.

Emery. — No. 4 to No. 54 to Flour, CF

	46 gr.	150 gr.	F. FF.
Kegs, ₩ lb	4½¢	5 ¢	2½¢
½ kegs, ₩ lb	4¾¢	5½¢	2¾¢
¼ kegs, ₩ lb	5 ¢	5½¢	3 ¢
10-lb cans, 10 in case	6 ¢	6½¢	5 ¢
10-lb cans, less than 10	10 ¢	10 ¢	7½¢

Enameled and Tinned Ware—See Ware, Hollow.

Escutcheon Pins—See Pins, Escutcheon.

Escutcheons.

Door Lock....Same dis as Door Locks.
Brass Thread.....60@60&10%
Wood.....25%

Expanded Metal.

List No. 5.

Lathing.....10%
Fencing, Painted Sheets.....20%
Netting, Painted Sheets.....20%
Door Mats, Galvanized.....25%
Window Guards, Paneled.....15%
Tree Guards, Paneled.....15%

Fasteners, Blind—

Mackrell's, ₩ doz. $1.00.....20@20&10%
Van Sand's Screw Pat., $15 ₩ gr..60&10%
Van Sand's Old Pat., $15.00 ₩ gr..55&10%
Washburn's Old Pattern, ₩ gr.....$9.00
Merriman's.....new list
Austin & Eddy No. 2008 ₩ gr.....$9.00
Security Gravity, ₩ gr.....$9.00

Faucets,—

Fenn's.....40%
Bohren's Pat. Rubber Ball.....25%
Fenn's Cork Stops.....33⅓%
Star.....60%
Fray's Pat. Petroleum.....40&5&2%
B. & L. B. Co.
West's Lock, Open and Shut Key..50%
Star, Metal Plug, new list.....40%
Lockport, Metal Plug, reduced list..60%
Metallic Key, Leather Lined....60&10@60&10&10%
Cork Lined.....70&5@70&10%
Burnside's Red Cedar.....50%
Burnside's Red Cedar, bbl lots....50&10%
John Sommers'
Peerless Best Block Tin Key.....40%
IXL, 1st quality, Cork Lined.....50%
Diamond Lock.....40%
Perfection, Fla. Red Cedar.....50%
Goodenough Cedar.....50%
Boss Metallic Key.....50%
Reliable Cork Lined.....60%
Western Pattern Cork Lined.....50%
Self-Measuring
Enterprise, ₩ doz $50.00.....20&10%
Lane's, ₩ doz $36.00.....25&10%
Victor, ₩ doz $36.00.....25&10%

Felloe Plates—See Plates, Felloe.

Fifth Wheels,—

Derby and Cincinnati.....45&5%
Brewster.....50&5%

Files—

Domestic—

Nicholson Files, Rasps, &c.....60&10@60&10&5%
Nicholson (X. F.) Files.....25%
Nicholson's Royal Files (Seconds).....75%
(extra prices on certain sizes)
Other makers, best brs.nds60&10@60&20%
Fair brands.....60&10&10@70&5%
Second quality.....70&10@75&10%
Nicholson's Horse Rasps....60x10@60& 10&5%
Heller's Horse Rasps.....50&7½@50&10%
McCaffrey's Horse Rasps.....50&10%
Chelsea Horse Rasps, Hand Cut,..50&10%

Imported—

Moss & Gamble....List, April 1, 1883, 15%
Butcher.....Butcher's list, 20%
Stubs.....Stubs list, 25@30%
Turton's.....Turton's list, 20@25%
Greaves' Horse Rasps..American list, 60%

Fixtures.

Grindstone—

Sargent's Patent.....70&10%
Reading Hardware Co.....30&10%
P., S. & W. Co.....50&10%

Fluting Machines—See Machines, Fluting.

Fluting Scissors—See Scissors, Fluting.

Fodder Squeezers—See Squeezers, Fodder.

Forks—

Hay, Manure, &c., Asso. List....66⅔@70%
Hay, Manure, &c., Phila. List.....25%
Plated, see Spoons.

Frames—

Saw—

White Vermont.....₩ gro $9.00@10.00
Red, Polished and Varnished.....₩ doz $1.50, 25%

Screen, Window and Door—

Porter's Pat. Window and Door Frame. 33⅓&10%
Warner's Screen Corner Irons..33⅓&5
33⅓&10%
Stearns' Frames and Corners..25@25&10%

Freezers, Ice Cream—

White Mountain.....60@60&5%
Granite State.....65@65&5%
Arctic.....70@70&5%
American.....60%
Buffalo Champion.....65@65&5%
Shepard's Lightning.....65@65&5%
Gem.....65%
Blizzard.....70%
Double Action Crown.....60%
Crown.....60%
Star.....60%
Peerless and Giant.....60&10%
Zero and Pet.....65&10%
Boss.....65&10@10%
Keystone, P. D. & Co., each, $1.50....30%

Fruit and Jelly Presses—See Presses, Fruit and Jelly.

Fry Pans—See Pans, Fry.

Funnels.

Gersdorff's Perfection, Standard and Globe; Tin, 1 gro., 10 %; 2 to 5 gro., 20 %; 5 to 10 gro.....30 %
Copper, 1 to 6 doz., 15 %; 6 to 12 doz., 20 %; over 12 doz.....25 %

Fuse— ₩ 1000 ft

Common Hemp Fuse, for dry ground..$2.70
Common Cotton Fuse, for dry ground 2.85
Single Taped Fuse, for wet ground..
Double Taped Fuse, for very wet gr.. 4.85
Triple Taped Fuse, for very wet gr.. 5.00
Small Gutta Percha Fuse, for water. 7.50
Large Gutta Percha Fuse, for water.12.00

Gates, Molasses—

Stebbin's Pattern.....75&10@80%
Stebbin's Genuine.....60&10&10%
Stebbin's Tinned Ends.....40&10%
Chase's Hard Metal.....50&10%
Sush's.....30%
Lincoln's Pattern.....70@70&10%
Weed's.....30&10%
Boss, ₩ doz:
No. 1, $7; No. 2, $8; No. 3, $9; No. 4, $10.....60&10&10%

Gauges.

Marking, Mortise, &c.....60&10%
Starrett's Surface, Center and Scratch. 25&10%
Wire, low list.....10&10%
Wire, Wheeler, Madden & Co.....10%
Wire, Morse's.....25%
Wire, Brown & Sharpe's.....10@20%
Wire, P. S. & W. Co.....10&10%

Gimlets—

Nail and Spike.....50&10&5%
" Eureka " Gimlets.....40&10%
" Diamond " Gimlets.....₩ gr $5.00
Double Cut, Shepardson's.....45@45&5%
Double Cut, Ives'.....60@60&5%
Double Cut, Douglass'.....40&10%
" Bee," ₩ gr $12.....25@25&5%

Glue—

Le Page's Liquid.....25@25&5%
Upton's Liquid.....35%
Le Page & Co.'s Improved Process 25@25&5%

Glue Pots—See Pots, Glue.

Grease, Axle.

Fraser's.....Keg ₩ lb 4¢, Pail ₩ lb 5¢
Fraser's, in boxes.....₩ gr $9.50
Dixon's Everlasting, in bxs..₩ doz 1 lb $1.20; 2 lb $2.00
Dixon's Everlasting....10-lb pails, ea. 35¢
Lower grades, special brands, ₩ gr $5.50@$7.00

Grindstones—

Small, at factory.....₩ ton $7.50@9.00

Grindstone Fixtures—See Fixtures, Grindstone.

Hack Saws—See Saws.

Hafts, Awl.

Sewing, Brass Fer. ₩ gr, $3.50.....45&10%
Pat. Sewing, Short..$1.00 ₩ doz.....40&10%
Pat. Sewing, Long.....₩ doz $1.20
Pat. Peg, Plain Top.₩ gr $10.00...45&10%
Pat. Peg, Leather Top.₩ gr $12.00.45&10%

Halters.

Covert's, Rope, ½-in. Jute..... 50&2%
Covert's, Rope, ½-in. Hemp .....50&2%
Covert's Adj. Rope Halters .....40&2%
Covert's Hemp Horse and Cattle Tie, 50&2%
Covert's Jute Horse and Cattle Ties, 60&10&2%
Covert's Adj. Web Halters .....35&2 %

Hammers—

Handled Hammers—

Maydole's, list Dec. 1, '85.....25&10@35%
Buffalo Hammer Co.....
Humason & Beckley .....
Atha Tool Co.....50@50&10%
Fayette R. Plumb.....
C. Hammond & Son.....
Verree.....
Hartford, Nail Hammers...35&10@40&5%
Hartford, Machinists, &c .....50@50&10%
Magnetic Tack, Nos. 1, 2, 3, $1.20, 1.50 & 1.75.....30&10%
Nelson Tool Works.....40&10%
Warner & Nobles.....20@25
Peck, Stow & Wilcox 40%
Sargent's.....33⅓&10%

Heavy Hammers and Sledges—

3 lb and under.....₩ lb 40¢
3 to 5 lb.....₩ lb 36¢ 70@70&10%
Over 5 lb.....₩ lb 30¢
Wilkinson's Smiths.....10½¢@11¢₩ lb

Handcuffs and Leg Irons—See Police Goods,

Handles—

Atkins' No. 1 Loop, ₩ pair, 28¢; No. 13¢; No. 8, 16¢; No. 2 and No. Reversible, 18¢.

Cross-Cut Saw Handles—

Boynton's Loop Saw Handles, 50¢....60%
Champion.....15%

Iron, Wrought or Cast—

Door or Thumb.

Nos.	0	1	2	3
Per doz.	$0.90	1.00	1.18	1.25

1.50 60&10&10%

Roggin's Latches.....₩ doz 30@35%
Bronze Iron Drop Latches..₩ doz 70% net
Jap'd Store Door Handles—Nuts, $1.62; Plate, $1.10; no Plate, $0.88 ..... net
Barn Door, ₩ doz $1.40..... 10&10%
Chest and Lifting..... 70%

Wood—

Saw and Plane.....40&10@40&10&5%
Hammer, Hatchet, Axe, Sledge, &c...40%
Brad Awl.....₩ gr $2.00
Hickory Firmer Chisel, ass'd. ₩ gr 4.50
Hickory Firmer Chisel, large. ₩ gr 5.00
Apple Firmer Chisel, ass'd... ₩ gr 5.00
Apple Firmer Chisel, large... ₩ gr 6.00
Socket Firmer Chisel, ass'd... ₩ gr 3.00
Socket Framing Chisel, ass'd. ₩ gr 5.00
J. S. Smith & Co.'s Pat File..... 50%
File, assorted..... ₩ gr ? 75 } 40@
Auger, assorted..... ₩ gr 5.00 } 40&10%
Auger, large..... ₩ gr 7.00 }
Pat. Auger, Ives'..... 30&10%
Pat. Auger, Douglass..... ₩ set $1.25
Pat. Auger, Swan's..... ₩ set $1.00
Hoe, Rake, Shovel, &c. ..... 50&10%

Hangers—

Barn Door, old patterns...60&10&10@70%
Barn Door, New England...60&10&10@70
Samson Steel Anti-Friction..... 55%
Orleans Steel..... 55%
Hamilton Wrought Wood Track..... 55%
U. S. Wood Track..... 65%
Champion..... 60&10%
Rider and Wooster, Medina Mfg. Co.'s list..... 70%
Climax Anti-Friction..... 60%
Climax Anti-Friction for Wood Track 55%
Zenith for Wood Track..... 55%
Reed's Steel Arm..... 50%
Challenge, Barn Door..... 50%
Sterling's Imp'ved (Anti-Friction).65&10%
Victor, No. 1, $15.00; No. 2, $16.50; No. 3, $18.00..... 50&2%
Cheritree..... 50&10%
Kidder's..... 50&10@60%
The Boss..... 60&10%
Best Anti-Friction..... 60&10%
Duplex (Wood Track)..... 60&10&5%
Terry's Pat., ₩ doz pr. 4 in, $10.00; 5 in. $12.00..... 50&10%
Terry's Steel Anti-Friction Leader 50&10%
Terry's Steel Anti-Friction Ideal..50&10%
Cronk's Patent, Steel Covered.....50@5%
Wood Track Iron Clad, ₩ ft. 10¢.....50 &15@60%
Carrier Steel Anti-Friction.....50&10%
Architect, ₩ set $6.00..... 20%
Eclipse..... 20&10%
Felix, ₩ set $4.50..... 20%
Richards'..... 30@30&10%
Lane's Standard.....50&5@50&10%
Lane's New Standard.....50@50&5%
Ball Bearing Door Hanger..20&10@25&10%
Warner's Pat.....20&10@20&10&10%
Stearns' Anti-Friction.20&10@20&10&10%
Stearns' Challenge.....25&10@25&10&10%
Faultless..... 40@40&5%
American, ₩ set $6.00..... 20&10%
Rider & Wooster, No. 1, 62½¢; No. 2, 75¢..... 40%
Paragon, Nos. 1, 2 and 3..... 40&10%
Cincinnati..... 25&10%
Paragon, Nos. 5, 5¼, 7 and 8..... 20&10%
Crescent.....60@60&10%
Nickel Cast Iron..... 50%
Nickel, Malleable Iron and Steel.....40%
Scranton Anti-Friction Single Strap33⅓%
Wild West, 4 in. Wheel, $15.00; 5 in. Wheel, $21.00..... 45%
Star..... 40&10@40&10&5%
May..... 50&5@50&10%
Barry, $6.00..... 40&10%

Harness Snaps—See Snaps.

Hatchets—

American Axe and Tool Co.
Blood's.....
Hunt's.....
Hurd's.....
Mann's.....
Peck's.....
Underhill's..... } 40 & 10 @ 50&5%
Buffalo Hammer Co.....
Fayette R. Plumb.....
C. Hammond & Son.....
Kelly's.....
Sargent & Co.....
P., S. & W. Co.....
Ten Eyck Edge Tool Co.....
Collins..... 10%
Schulte, Lohoff & Co..... 50@50&5%

Hay and Straw Knives—See Knives.

Hinges—

Blind Hinges—

Parker..... 75&2%
Palmer..... 50&5&10%
Seymour..... 70&2%
Nicholson..... 45&10%
Huffer..... 50%
Clark's, Nos. 1, 3, 5, 40 and 50 75&10&5@30%
Clark's Mortise Gravity..... 50%
Sargent's, Nos. 1, 3, 5, 11, 13 75&10@55&10&5%
Sargent's, No. 12..... 77&10&10%
Reading's Gravity.....75&10@75&10&5%
Shepard's
Noiseless..... 75&10%
Niagara..... 80%
Buffalo..... 80%
Clark's Genuine Pattern..... 80%
O. S., Lull & Porter..... 75&10%
Acme, Lull & Porter..... 75%
Queen City Reversible....70&10&5@75%
Clark's Lull & Porter, Nos. 0, 1, 1½, 2, 2½, 3..... 75&10@2½%
North's Automatic Blind Fixtures, No. 2, for Wood, $9.00; No. 3, for Brick, $11.50. ..... 10%

Gate Hinges—

Western.....₩ doz $4.40, 60%
N. E.....₩ doz $7.00, 55%
N. E. Reversible.....₩ doz $5.20, 55&10%
Clark's, Nos. 1, 2, 3.....60&10&5%
N. Y. State.....₩ doz $5.00, 55&10%
Autcmatic.....₩ doz $12.50, 50%
Common Sense.....₩ doz pair $4.50, 50%
Seymour's..... 45&10%
Shepard's.....60&10&5%
Reed's Latch and Hinges. ₩ doz $12.00, 50%

Spring Hinges—

Union Spring and Blank Butts..... 40%
Gear's Spring Hinge Co.'s list, March 1886 ..... 20%
Acme..... 30%
J. S..... 25&10%
Empire and Crown..... 20%
Hero and Monarch..... 55%
American, Gem, and Star..... 20%
Oxford..... 20%
Barker's Double Acting..... 25%
Union Mfg. Co..... 25%
Bommer's..... 30%
Buckman's.....15@20%
Chicago..... 30%
Wiles'..... 10%
Devore's..... 40%
Rex..... 40%
Royal..... 60%
Reliable..... 60%
Champion..... 60%
Bardsley's Patent..... 40%
Stearn's.....50&10%

Wrought Iron Hinges

Strap and T..... 75&10%
Screw Hook and Strap..... 6 to 12 in., ₩ D. 4 2-10¢ / 14 to 20 in., ₩ D. 3 7-10¢ / 22 to 36 in., ₩ D. 3 2-10¢
Heavy Welded Hook..... 6 to 12 in., ₩ D. 4 2-10¢ / 14 to 20 in., ₩ D. 3 7-10¢ / 22 to 36 in., ₩ D. 3 2-10¢
Screw Hook and Eye..... ⅛ in., ₩ doz $1.50 / ¼ in., ₩ doz $2.45 / ¾ in., ₩ doz $3.80 } 10%
Rolled Blind Hinges, Nos. 32 and 34 50&10%
Rolled Blind Hinges, Nos. 232 and 234 55&10%
Rolled Plate..... 70&10%
Rolled Raised..... 70&10%
Plate Hinges { 8, 10 & 12 in., ₩ D. .....5¢ / "Providence" { over 12 in., ₩ D. ....4¢

Hoes—

Eye—

D. & H. Scovil..... 20%
Lane's Crescent Planters Pattern..45&5%
Lane's Razor Blade, Scovil Pattern...30%
Maynard, S. & O. Pat..... 45&5%
Sandusky Tool Co., S. & O. Pat. } 50&10&5
Am. Axe and Tool Co., S. & O. Pat. } @60%
Chattanooga Tool Co., S. & O. Pat..60& 5@60&10%
Grub..... 60&10%

Handled—

Garden, Mortar, &c..... 66⅔&70%
Planter's, Cotton, &c..... 66⅔&70%
Warren Hoe..... 60%
Magic..... ₩ doz $4.00

Hog Rings and Ringers—See Rings and Ringers.

Hoisting Apparatus—See Machines, Hoisting.

Hollow-Ware—See Ware, Hollow.

Holders.

Bag.

Sprengle's Pat.....₩ doz $18.....60%

Bit.

Extension, Barber's, ₩ doz $15.00.....40@40&10%
Ives, ₩ doz $20.00.....60&5@60&10%
Diagonal..... ₩ doz $24.00, 40%
Angular..... ₩ doz $24.00, 40&5%

File and Tool—

Bals Pat.....₩ doz $4.00; 25%
Nicholson File Holders..... 20%
Dick's Tool Holder..... 20%

Hooks—

Cast Iron—

Bird Cage, Sargent's list..... } 60&10&10%
Bird Cage, Reading..... }
Clothes Line, Sargent's list.. }
Clothes Line, Reading list. 60&10@60&10&10%
Ceiling Sargent's list..... 55&10&10%
Harness, Reading list..55&10@55&10&10%
Coat and Hat, Sargent's list. 55&10@60&10%
Coat and Hat, Reading .50&10@50&10&10%

Wrought Iron—

Cotton.....₩ doz $1.25
Cotton Pat. (N.Y. Mallet & Handle W'ks). 30%
Tassel and Picture (T. & S. Mfg. Co.)...50%
Wrought Staples, Hooks, &c. See Wrought Goods.

Wire—

Wire Coat and Hat, Gem, list April, 1886..... 50%
Wire Coat and Hat, Miles', list April, 1886..... 50%
Indestructible Coat and Hat..... 45%
Wire Coat and Hat, Standard..... 60%
Handy Hat and Coat..... 50&10%
Steady Ceiling Hooks..... 50&10%
Belt..... 80@80&10%
Atlas, Coat and Hat..... 60%

Miscellaneous.

Grass, No. 2, $2.00; No. 3, $2.25; No. 4, $2.50
Nolin's Grass.....₩ doz $2.25
Bush..... 55@60%
Whiffletree—Patent..... 55%
Hooks and Eyes—Malleable Iron. 70@70&10%
Hooks and Eyes—Brass.....60&10&10%
Fish Hooks, American..... 50%
Bench Hooks .....See Bench Stops.

Horse Nails—See Nails, Horse.

Horse Shoes—See Shoes, Horse.

Hose, Rubber—

Competition..... 75@75&5%
Standard.....60&10&5@60&10&10%
Extra..... 50&10@60%
N. Y. B. & P. Co., Para..... 25&5%
N. Y. B. & P. Co., Extra..... 40@40&5%
N. Y. B. & P. Co., Dundee... 70&10 @ 60%

Huskers—

Blair's Adjustable..... ..₩ gr $8.00
Blair's Adjustable Clipper. ..₩ gr 7.00
Hubbard's Solid Steel.....₩ gr 4.50

Indurated Fiber-Ware—See Ware, Indurated Fiber.—

Irons.

Sad—

From 4 to 10, at factory ...₩ 100 ℔, $2.30@$2.40.
Self-Heating.....₩ doz $9.00 net
Self-Heating, Tailors'....₩ doz $18.00 net
Mrs. Pott's Irons..... ..50&5%
Enterprise Star Irons.. ..50&5%
Cold Handle Sad Irons..... ..50&5%
Ideal Irons new list.50&10@50 & 10&10%
Salamander, Irons..... ..25%
B. B. Sad Irons, ₩ ℔.....3 @3¼¢
Combined Fluter and Sad Iron, ₩ doz, $15.00..... 15%
Fox Reversible, Self-Fluter ₩ doz $24.00
Chinese Laundry (N.E. Butt Co.) 8½¢. 15%
New England..... 5¢. 15%
Mahony's Troy Pol. Irons..... 25%
Sensible.....20@20&5%
National Self-Heating..... 30%

Soldering—

Soldering Coppers..... ₩ ℔ 22 @ 23¢
Covert's Adjustable, list Jan. 1, 1886. 35&2%

Irons, Pinking, per doz., 65¢.

Jack Screws—See Screws.

Jacks, Wagon.

Daisy..... 33⅓%
Victor..... 33⅓%

Kettles—

	Spun.	Stamped.
Brass, 7 to 17 in., ₩ ℔....	24¢	22 ¢
Brass larger than 17 in., ₩ ℔.....	20¢	24½¢

Enameled and Tea—See Hollow-Ware.

Keys—

Lock Asso'n list Dec. 30, 1886...50&10@60&5%
Eagle, Cabinet, &c..... 33⅓&2%
Hotchkiss' Brass Blanks..... 40%
Hotchkiss, Copper and Tinned..... 40%
Hotchkiss' Pad. and Cab..... 35%
Ratchet Bed Keys.....₩ doz $4.00, 15%
Wollensak Tinned.....50&10%

Knife Sharpeners—See Sharpeners, Knife.

Knives.

Butcher, Shoe, &c—

Wilson's Butcher Knives.....25@30%
Ames' Butcher Knives..... 25%
Foster Bros.' Butcher, &c..... 40%
Nichols' Butcher Knives.....40&10%
Ames' Shoe Knives.....20@25%
Ames' Bread Knives. ₩ doz $1.50, 15@20%
Moran's Shoe and Bread..... 20%
Hay and Straw.....See Hay Knives.
Table and Pocket.....See Cutlery.
Corn, Auburn Mfg. Co. Western Pat. $2.00
Corn, Auburn Mfg. Co. Crescent.....$3.50

Corn—

Bradley's..... ..10%
Wadsworth's..... ..25%

Drawing—

Witherby..... } ..75@75&10%
P. S. & W..... }
Mix..... }
New Haven..... }
Merrill .....60&10@60&10&5%
Douglas.....75@75&5%
Watrous.....15&10@25%
L. & I. J. White.....20&5%
Bradley's..... 35%
Adjustable Handle.....25@33⅓%
Wilkinson's Folding.....25@25&5%

Hay and Straw—

Lightning, Mfrs'. price ₩ doz $18.00, 25% But jobbers cut this price freely, often selling at $8 @ $8.50.
Wadsworth's.....40&7½@40&10%
Carter's Needle.....₩ doz $11.00@$11.50
Heath's.....₩ doz $13.00@13.50
Auburn Hay, Com. and Spear Point..50%
Auburn, Straw..... 40%
Nolin's Hay ..... ₩ doz. $7.00 @ $8.00

Mincing.

Am. (2d quality), ₩ gr., 1 blade, $7; 2 blades, $12; 3 blades, $18.....net
Lothrop's..... 20&10%
Smith's, ₩ doz, Single, $2.00; Double, $3 40@45%
Knapp & Cowles.....50&10@60%
Buffalo Adjustable..... ₩ doz $3.00 .25%
Buffalo Double Adj'table. ₩ doz $3.00 25%

Knobs—

Door Mineral..... ..60@65%
Door Por. Jap'd.....70@75%
Door Por. Nickel.....$2.00@2.25
Door Por. Plated, Nickel.....$2.00@2.25
Drawer, Porcelain.....60@10@60@10&10%
Hemacite Door Knobs.....40@10@50%
Yale & Towne Wood, list Dec., 1885...40%
Furniture, Plain.....75¢ gro inch. 10%
Furniture, Wood Screws..... 25&10%
Base, Rubber Tip.....70&10&5%
Picture, Judd's.....60&10&10@70%
Picture, Sargent's..... 70&10%
Picture, Hemacite..... 35&5%
Shutter, Porcelain..... 65&10%
Carriage, Jap.....₩ gro 80¢, 60&10%
Bardsley's Wood Door, Shutter, &c..40%

Ladies.—

Melting, Sargent's.....	55&10%
Melting, Reading.....	35&10%
Melting, Monroe's Pat..₩ doz $4.00, 40%	
Melting, P. S. & W.....	35&10@40%
Melting, Warner's.....	30%

Lanterns—

Tubular—

Plain with Guards, ₩ doz.....$4.00@4.25
Lift Wire, with Guards.....$4.50@4.75
Square Plain, with Guards.....$4.00@4.25
Sq. Lift Wire, with Guards.....$4.25@4.50
Without Guards, 25¢ ₩ doz less.

Miscellaneous.

Police, Small, $6.00; Medium, $7.25; Large, $9.75..... 20@25%

Lawn Mowers—See Mowers, Lawn.

Leaders, Cattle.

Humason. Beckley & Co.'s..... 70%
Sargent's.....60%&10%
Hotchkiss..... 30%
Peck, Stow & W. Co..... ...60&10%

Lemon Squeezers—See Squeezers, Lemon.

Lifters, Transom.

Wollensak's:
Class 3 and 4, Bronzed Iron..... 50%
Class 3 and 4, Bronze Metal..... 25%
Class 3 and 4, Brass..... 35%
Skylight Lifters..... 35%
Crown, Eagle and Shield..... 50%
Reither's, list Sept. 1, 1890.
Bronzed Iron Rods.....50&10&10&2%
Brass, Real Bronze or Nickel Plate. 30%
Excelsior.....50&10&2%
Shaw's.....50&10%
Payson's:
Universal..... 60%
Solid Grip..... 60%
Imperial.....50&10%

Lines—

Cotton and Linen Fish, Draper's.....50%
Draper's Chalk..... 60%
Draper's Masons' Linen, 84 ft., No. 1, $1.25; No. 2, $1.75; No. 3, $2.25; No. 4, $2.75; No. 5, $3.25..... 25%
Cotton Chalk..... 50%
Samson, Cotton, No. 4, $2; No. 4½, $2.50; 10%
Silver Lake, Braided, No. 0, $6.00; No. 1, $6.50; No. 2, $7.00; No. 3, $7.50 ₩ gro..... 35%
Mason's Linen, No. 3½, $1.50; No. 4, $2.00; No. 4½, $2.50..... 40%
Mason's Colored Cotton..... 45%
Wire Clothes.. Nos. 12 19 20
100 ft. $4 00 $3 50 $3.00
Ventilator Cord, Samson Braided, White or Drab Cotton..₩ doz $7.50, 50%

Locks, &c.—

Cabinet—

Eagle, Gaylord Parker and Corbin... } List March, '84, Jan.1,'85..33⅓&2%
Deitz, Nos. 36 to 39..... 40%
Deitz, Nos. 51 to 63..... 40&10%
Deitz, Nos. 86 to 96..... 30%
Stoddard Lock Co.....30&33⅓%
"Champion" Night Latches..... 40%
Barnes Mfg. Co.....40@40&10%
Eagle and Corbin Trunk.....25&2%
"Champion" Cab. and Combin...33⅓%
Yale..... net prices
Romer's..... 25%

Door Locks, Latches, &c.

R. & E. Mfg. Co., list Mar. 20, 1889..... 60&10@60&10&10
Mallory, Wheeler & Co., list July, '88..... Much lower net prices often made.
Sargent & Co., list Aug. 1, '88.....
Reading Hardware Co., list Feb. 2, '88.....
Brittan, Graham & Mathes, list Jan. 1890..... 60&10&10%
Perkins' Burglar Proof.....60&25%
Plate..... 33⅓&2%
Barnes Mfg. Co.....40@40&10%
Yale..... net prices
Deitz Flat Key..... 30%
L. & C. Round Key Latches..... 30&10%
L. & C. Flat Key Latches..... 33⅓&10%
Romer's Night Latches..... 15%
Shepardson or U. S..... 35%
Seed's N. Y. Hasp Lock..... 25%

Padlocks—

List Dec. 23, '84.....75@75&10%
Brittan, Graham & Mathes..... 75&10%
Yale Lock Mfg. Co.'s..... net prices
Eagle..... 25&2%
Eureka, Eagle Lock Co..... 40&2%
Romer's, Nos. 0 to 91..... 30%
Romer's Scandinavian, &c., Nos. 100 to 505..15%
A. E. Deits..... 40%
Champon Padlocks..... 40%
Hotchkiss..... 30%
Star..... 45%
Horseshoe.....₩ doz, $9. 40@40&10%
Barnes Mfg. Co.....40@40&10%
Nock's..... 30%
Brown's Pat..... 25%
Scandinavian.....90@90&10%
E. T. Fraim's Keystone Scandavian: Nos. 119, 120, 130 and 140..... .90&10%
Other Nos..... 65%
Ames Sword Co. up to No. 150..... 40%
Ames Sword Co. above No. 150..... 50%
Slaymaker Barry & Co.
No. 41 line..... 45&5%
No. 31 line..... 60&5%
No. 21 line..... 75@5%

Sash, &c.

Clark's, No. 1, $10; No. 2, $8 ₩ gr.. .33⅓%
Ferguson's..... 33⅓%
Morris and Triumph, list Aug. 16, 1886. 60&2%
Victor.....60&10&2%
Walker's..... 10%
Attwell Mfg. Co.....25&33⅓%
Reading.....66⅔&10@66⅔&10&10%
Hammond's Window Springs..... 40%
Common Sense, Jap'd, Copd and Bi'zed.....₩ gr $4.00
Common Sense, Nickel Plated ₩ gr $10.00
Universal..... 30%
Kempshall's Gravity..... 60%
Kempshall's Model..... 60@60&10%
Corbin's Daisy, list Feb. 15, 1886.....70%
Payson's Perfect.....60@60&10%
Hugunin's Sash Balances.....25&5&2%
Hugunin's New Sash Locks.....25&5&2%
Stoddard "Practical"..... 10%
Ives' Patent.....60&10@60&10&5%
Lieseche's, Nos. 100 and 110, ₩ gr $8; 105, $10.00..... 20&10%
Davis, Bronze, Barnes Mfg. Co..... 50%
Champion Safety, list March 1, 1888 55@55&5%
Security..... 70%
Buckeye.....₩ gro $4.80

Lumber Tools—See Tools, Lumber

Lustre—

Four-ounce Bottles....₩ doz, $1.75; ₩ gross..... $17.00

Machines.

Boring—

Without Augers.	Upright.	Angular.	
Douglas.....	$5.50	$6.75	.....50%
Snell's, Rice's Pat.	5.50	6.75	...40&10&10
Jennings	5.50	6.75	...45@45&10
Other Machines...	2.35	2.75	.....
Phillips' Patent with Augers ...	7.00	7 50	.....

Fluting.

Knox, 4½-inch Rolls .....$3.25 each } 35%
Knox, 6-inch Rolls.. .....$3.60 each }
Eagle, 3½-inch Roll, $2.15..... 35%
Eagle, 5½-inch Roll, $2.85..... 35%
Crown, 4½ in., $3.50; 6 in., $4.00; 8 in., $6.50 each 35%
Crown Jewel, 6 in .....$3.50 each, 35%
American, 5 in., $3.00; 6 in., $3.40; 7 in., $4.50 each..... 35%
Domestic Fluter ..... each, $1.50
Geneva Hand Fluter, White Metal ₩ doz $12, 25%
Crown Hand Fluter, Nos. 1, $15.00; $12.50; 3, $10.00..... 30%
Shepard Hand Fluter, No. 85 ₩ doz $15 30 40

Shepard Hand Fluter, No. 110 ₱ doz $11.00.....40%
Shepard Hand Fluter, No. 95 ₱ doz $8.00.....40%
Clark's Hand Fluter. ₱ doz $15.00.....35%
Combined Fluter and Sad Iron, ₱ doz $15.00.....30% ₱ doz $10.00.....10%
Buffalo .....

Hoisting—
Moore's Hand Hoist, with Lock Brake.....20%
Moore's Differential Pulley Block...40%
Energy Mfg. Co's.....25%

Mallets.

Hickory.....20&10@20&10&10%
Lignumvitæ.....20&10@20&10&10%
B. & L. Block Co., Hickory & L. V. ₱ 30@30&10%

Mattocks. Regular list.....60&10%

Measures—
Standard Fiberware, No. 1, peck, ₱ dozen, $4; ½-peck, $3.50.

Meat Cutters—See Cutters, Meat.

Mills.

Coffee—
Box and Side, List Jan. 1, 1888.....60&2%
American, Enterprise Mfg Co.20&10@30%
The Swift, Lane Bros.....20&10%

Mincing Knives — See Knives, Mincing.

Molasses Gates—See Gates, Molasses.

Money Drawers — See Drawers, Money.

Mowers, Lawn.

Leading makers.....60@60&10&5%
Other makers.....60&10&5@60&10&10%
Pennsylvania.....60%
Continental.....60&10&5%
New Model.....60&10&5%
New Quaker City.....60&10&5%
Great American.....60&10&5%

Muzzles—
Safety.....₱ doz, $3.00, 25%

Nails.

Cut and Wire. See Trade Report.
Wire Nails, Papered.
Association list, July 15, '89, .75@75&5%
Tack Mfrs.' list.....60&10&10%
Wire Nails, Standard Penny.
Card June 1, '89, base.....$2.70 @ $2.75

Horse—See Trade Report.

Nos.	6	7	8	9	10
Ausable	28¢	26¢	25¢	24¢	23¢.

40&5&2%

Clinton, Fin.	19¢	17¢	16¢	15¢	14¢..... 30
Essex	28¢	26¢	25¢	24¢	23¢. 25&10@25&10&10%
Lyra	19¢	17¢	16¢	15¢	14¢.....30
Snowden	19¢	17¢	16¢	15¢	14¢.....30
Putnam	23¢	21¢	20¢	19¢	18¢. 1000 ₱ in year 15%
Vulcan	23¢	21¢	20¢	19¢	18¢..12½&5%
Northwest'n	25¢	23¢	22¢	21¢	20¢. 25@25&5%
Globe	23¢	21¢	20¢	19¢	18¢...25&10%
Boston	23¢	21¢	20¢	19¢	18¢. 20&5&2½%
A. C	25¢	23¢	22¢	21¢	20¢. 25&10@33⅓&5%
C. B.-K	25¢	23¢	22¢	21¢	20¢. 25&10@33⅓&5%
Maud S	25¢	23¢	22¢	21¢	21¢. 40&10&5&2%
Champlain	28¢	6¢	25¢	24¢	23¢. 25&10@10%
New Haven	28	26¢	25¢	24¢	23¢. 25&10@25&10&10%
Saranac	23¢	21¢	20¢	19¢	18¢...30&10%
Champion	25¢	23¢	22¢	21¢	20¢. 10&10&10%
Capewell	28¢	26¢	5¢	24¢	23¢. 35&5@35&10%
Star	23¢	21¢	ve	19¢	18¢. 10&10@10&12½%
Anchor	23¢	21¢	20¢	19¢	18¢.....35%
Western	23¢	21¢	20¢	19¢	18¢...40&10%
Empire Bronzed					14 ₱ lb.

Picture—
Brass Head, Sargent's list.....50&10&10%
Brass Head, Combination list.....50&10%
Porcelain Head, Sargent's list.50&10&10%
Porcelain Head, Combination list..40&10%
Niles' Patent.....40%

Nail Pullers.—See Pullers, Nail.

Nail Sets.—See Sets, Nail.

Nut Crackers.—See Crackers, Nut.

Nuts—

Nuts, off list Dec. 18, 1889:	Square.	Hex.
Hot Pressed	5.45¢	6.00¢
Cold Punched	5.00¢	4.90¢

In lots less than 100 ₱, ₱ lb. add ½¢ to 1-₱ boxes, add 1¢ to list.

Oakum—

Government.....₱ ₱ 7@7½¢
U. S. Navy.....₱ ₱ @6½¢
Navy.....₱ ₱ 5½@5½¢

Oilers—
Zinc and Tin.....65&10@70%
Brass and Copper.....50&10&50&10&5%
Malleable, Hammers' Improved, No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₱ doz. 10&10&5%
Malleable, Hammers, Old Pattern, same list.....40%
Prior's Pat. or "Paragon" Zinc, 60&10&10%
Prior's Pat. or "Paragon" Brass.....50%
Olmstead's Tin and Zinc.....60%
Olmstead's Brass and Copper.....50%
Broughton's Zinc.....60%
Broughton's Brass.....50%
Gem P. D. & Co. ₱ gro. $2
Steel, Draper and Williams.....50%

Openers, Can.

Messenger's Comet.....₱ doz $3.00, 25%
American.....₱ gross $3.00
Duplex.....doz 25¢, 15@20%
Lyman's.....₱ doz $3.75, 20%
No. 4 French.....₱ doz $2.25, 55@60%
No. 5, Iron Handle.....₱ gr $6.00, 45&50%
Eureka.....₱ doz $2.50, 10%
Sardine Scissors.....₱ doz $2.75@3.00.
Star.....₱ doz $2.75
Sprague, No 1, $2.00 2, $2.25; 3, $2.50 50&10&10%
Excelsior, No 1, $2.50; No. 2, $1.50..40%
World's Best, ₱ gross, No. 1, $12.00; No. 2, $24.00; No. 3, $36.00.....50&10%
Universal, ₱ doz $3.00.....40&5%
Domestic, ₱ doz $2.50.....40%
Champion ₱ doz $2.00.....50%

Packing, Steam—

Rubber—

Standard.....60&5@65%
Extra.....50@50&5%
N. Y. B. & P. Co., Standard..40&10@50%
N. Y. B. & P. Co., Empire.....60&5@65%
N. Y. B. & P. Co., Salamander. ₱ ₱ 65¢, 10@15%
Jenkins' Standard. ₱ ₱ 80¢,...35@25&5%

Miscellaneous—
American Packing.....10¢@11¢ ₱ ₱
Russia Packing.....14¢ ₱ ₱
Italian Packing.....13¢@14¢ ₱ ₱
Cotton Packing.....15¢@17¢ ₱ ₱
Jute.....7¢@8¢ ₱ ₱

Padlocks— See Locks.

Pails.

Galvanized Iron—

	Quarts	10	12	14
Gill's Light Weight, ₱ doz.	$2.75	3.00	3.25	
Gill's Heavy Weight, ₱ dz.	3.00	3.25	3.75	
Helwig's	2.75	3.00	3.25	
Sidney Shepard & Co.	2.35	2.85	3.05	
Iron Clad	2.50	2.75	3.00	
Fire Buckets	2.75	3.25	3.50	

Buckets, see Well Buckets.

Indurated Fibre Ware—25%
Star Pails, 12 qt.....₱ doz $6.00
Fire, Stable and Milk, 14 qt..₱ doz $7.80

Standard Fibre Ware—

	Plain.	Deer'd
Water Pails, 12 qt., per doz.	$4.00	$4.50
Dairy Pails, 14 qt., per doz.	4.50	5.00
Fire Pails, No. 1, 12 qt. per doz	4.50	
Fire Pails, No. 2, 14 qt. per doz	5.00	
Sugar Pails	6.00	6.50
Horse Pails	5.00	
Buggy Pails	4.00	
Slop Jars (bal. trap)	8.00	9.00
Chamber Pails, 14-qt	6.50	7.50

Pans.

Dripping.
Small sizes.....₱ ₱ 6¼¢
Large sizes.....₱ ₱ 5½¢
Silver & Co. (Covered).....40%

Fry—
Standard List:

No.	0	1	2	3	4
₱ doz.	$3.00	$3.75	$4.25	$4.75	$5.25
No.	5	6	7	8	
₱ doz.	$6.00	$7.00	$8.00	$9.00	

Polished, regular goods.....70&10%
Acme Fry Pans.....60&10%

Paper and Cloth—

Sand and Emery—
List April 19, 1886.....50&50&10%
Sibley's Emery and Crocus Cloth.....30%

Parers.

Apple.
Advance.....₱ doz $4.75
Baldwin.....₱ doz 5.25
Bonanza.....each 5.00
Champion.....₱ doz 7.25
Daisy.....₱ doz 4.00
Dandy.....each 7.50
Eureka, 1888.....each 16.00
Family Bay State.....₱ doz 12.00
Favorite.....₱ doz 5.00
Gem.....₱ doz 5.25
Gold Medal.....₱ doz 4.00
Ideal.....₱ doz 4.00
Improved Bay State..₱ doz 27.00 @ 30.00
Little Star.....₱ doz 4.50
Monarch.....₱ doz 13.50
New Lightning.....₱ doz 5.50
Oriole.....₱ doz 4.00
Penn.....₱ doz 4.00
Perfection.....₱ doz 4.00
Pomona.....₱ doz 4.00
Rocking Table.....₱ doz 6.00
Turntable.....₱ doz 4.50
Victor.....₱ doz 13.50
Waverly.....₱ doz 4.00
White Mountain.....₱ doz 4.00
72.....₱ doz 4.25
76.....₱ doz 5.75
78.....₱ doz. 6.50

Potato—
White Mountain.....₱ doz $4.50
Antrim Combination.....₱ doz $5.50
Hoosier.....₱ doz $18.50
Saratoga.....₱ doz $5.50

Pencils—
Faber's Carpenters'.....high list 50%
Faber's Round Gilt.....₱ gro $5.25
Dixon's Lead.....₱ gro $4.50
Dixon's Lumber.....₱ gro $6.75
Dixon's Carpenters'.....40&10%

Picks—
Railroad or Adze Eye, 5 to 6, $12.00; 6 to 7, $13.00.....60&10%

Picture Nails.—See Nails, Picture.

Pinking Irons.—See Irons, Pinking.

Pins.

Bow—
Humason, Beckley & Co.'s.....60&10%
Sargent & Co's....$17 and $18.....60&10%
Peck, Stow & W. Co..50&10&50&10%

Curtain—
Silvered Glass.....net
White Enamel.....net

Escutcheon,
Iron, list Nov. 11, 1885..50&10&50&10&5%
Brass.....60@60&5%

Pipe, Wrought Iron—
List September 18, 1889.
1¼ and under, Plain.....47½%
1¼ and under, Galvanized.....40%
1¼ and over, Plain.....50%
1¼ and over, Galvanized.....47½%
Boiler Tubes, Iron.
1¼ and under.....45%
2 to 4 inch.....50%
4-inch and larger.....52½%

Planes and Plane Irons—

Wood Planes—
Molding.....40&2%
Bench, First Quality.....55&2%
Bench, Second Quality.....60&2%
Bailey's (Stanley R. & L. Co.)....40&10%

Iron Planes—
Bailey's (Stanley R. & L. Co.)..... 40&10@40&10&10%
Miscellaneous Planes (Stanley R. & L. Co.)..... 20&10@20&10&10%
Victor Planes (Stanley R. & L. Co.)..... 20&10@20&10&10%
Steer's Iron Planes.....35@35&10%
Merrien Mal. Iron Co.'s.....40@40&10%
Davis's Iron Planes.....40@40&10%
Birmingham Plane Co.....50@50&10%
Gage Tool Co.'s Self-Setting...20&10&10%
Chaplin's Iron Planes.....40@40&10%
Sargent's..... 20&10@30&10&10%
Standard Tool Co.....50@50&5%

Plane Irons—
Butcher's.....$5.00@$5.25 to £
Buck Bros.....30%
Auburn "Thistle.....
Ohio.....35&2%
Sandusky.....
S. & I. J. White.....25%

Plates.

Felloe.....₱ ₱ 6¢@6¼¢

Pliers and Nippers—
Button's Patent.....50@50&10%
Hall's No. 2, 5 in., $13.50; No. 4, 7 in., $21.00 ₱ doz.....30&10@33⅓%
Humason & Beckley Mfg. Co..50@50&10%
Gas Pliers.....60%
Gas Pliers, Custar's Nickel Plated..60&5%
Eureka Pliers and Nippers.....40%
Russell's Parallel.....25%
P. S. & W. Cast Steel.....50%
P. S. & W. Tinners' Cutting Nippers, add 5% dis 10%
Carew's Pat. Wire Cutters.....20%
Morrill's Parallel, ₱ doz. $12.00.....30&5%
Cronk's 8 in., $15.00; 10 in. $21.00, 40@40&5%

Plumbs and Levels—
Regular List.....70&10@70&10&10%
Disston's.....50%
Pocket Levels.....70&10@70&10&10%
Davis Iron Levels.....30%
Davis' Inclinometers.....10&10%

Poachers.

Egg.
Buffalo Steam Egg Poachers, ₱ doz, No. 1, $6.00; No. 2, $9.00.....25%
Silver & Co., 6-Ring..₱ doz $4; 3-Ring $2

Pokes, Animal—
Bishop's I. X. L.....₱ doz $6.00
Bishop's O. K.....₱ doz $5.25
Bishop's Pioneer.....₱ doz $3.75
Bishop's American.....₱ doz $2.75
Eagle, Double Stale.....₱ doz $5.75
Eagle, Single Stale.....₱ doz $3.75
Buckeye, Single Stale.....₱ doz $2.75

Police Goods.
R. I. Tool Co., Handcuffs, $15.00₱ doz 10%
R. I. Tool Co., Leg Irons, $25.00 ₱ doz 10%
Tower's.....25%
Daley's Improved Handcuffs: 2 Hands, Polished, ₱ doz $48.00; Nickeled, $57.00: 3 Hands, Polished, ₱ doz $72.00; Nickeled, $84.00.....25%
J. P. Lovell's Police Goods.....25%

Polish, Metal.
Prestoline.....30%
Prestoline Paste.....33⅓%
Gaston's Silver Compound.....33⅓%

Polish, Stove.
Joseph Dixon's.....₱ gro $6.00, 10%
Gem.....₱ gro $4.50, 10%
Gold Medal.....₱ gro $6.00, 25%
Mirror.....₱ pro $6.00, —%
Lustro.....₱ gro $4.75
Ruby.....₱ gro $3.75
Rising Sun, 5 gro lots.....₱ gro $5.50
Dixon's Plumbago.....₱ ₱ 8¢
Boynton's Noon Day, ₱ gro.....13.00
Parker Pride Stove Enamel..₱ gro
Yates' Liquid, 2 3 5 10 gal....
₱ gal ...$0.80 .70 .60 .50
Yates Standard Paste Polish, 10-₱ cans, ₱ ₱ 12½¢
Jet Black.....₱ gro $3.50
Japanese.....₱ gro $3.50
Fireside.....₱ gro $2.50
Diamond O. K. Enamel.....₱ gro $19.00
Bonnell's Liquid Stove Polish.₱ gro $9.00
Bonnell's Paste Stove Polish..₱ gro $6.00
Black Eagle Benzine Paste, 5 and 10 ₱ cans.....12½¢
Black Jack Water Paste ,5 and 10 ₱ cans.....12½¢
Nickel Plate Paste.....₱ gro $6.00

Poppers, Corn—
Round or Square, 1 qt..₱ gr $10.00@10.50
Round or Square, 1½ qt..₱ gr $15@15.50
Round or Square, 2 qt..₱ gr $18.50@19.00

Post Hole and Tree Augers and Diggers—See Diggers, Post Hole, &c.

Potato Parers—See Parers, Potato.

Pots.

Glue—
Tinned.....40%
Enameled.....40&5%
Family, Howe's "Eureka".....40%
Family, L. F. C.'s "Handy".....50%

Presses.

Fruit and Jelly—
Enterprise Mfg. Co.....20&10@30%
Henis.....₱ doz $3.50
Shepard's Queen City.....40%
Silver & Co.....₱ doz $2.75

Pruning Hooks and Shears.—See Shears.

Pullers.

Nail.
Curtiss Hammer.....₱ doz $9.00
Giant, No. 1.....₱ doz. $15.00, 10%
Giant, No. 2.....₱ doz, $15.00, 10%
Pelican.....₱ doz, $9.00, 25%

Pulleys—
Hot House, Awning, &c.....60&10%
Japanned Screw.....60&10%
Brass Screw.....60&10%
Japanned Side.....60%&10%
Japanned Clothes Line.....60&10%
Empire Sash Pulley.....55@60%
Moore's Sash, Anti-Friction.....50%
Hay Fork, Solid Eye, $4.00; Swivel, $4.50.....50&10@50&10&5%
Hay Fork, "Anti-Friction," 5 in. Solid, $5.70.....50%
Hay Fork, "F" Common and Pat. Bushed.....20%
Hay Fork, Tarbox Pat. Iron.....20%
Hay Fork, Reed's Self-Lubricating...60%
Shade Rack.....45%
Tackle Blocks.....See Blocks
Moore's Anti-Friction 5 in. Wheel, ₱ doz $12.00.....40

Pumps—
Cistern, Best Makers.....60@60&10%
Pitcher Spout, Best Makers.....67½@70%
Pitcher Spout, Cheaper Goods.70@70&5%

Punches—
Saddlers' or Drive, good, ₱ doz...60@65%
Bemis & Call Co.'s Cast Steel Drive..50&5%
Bemis & Call Co's Springfield Socket.50&5%
Spring, good quality....₱ doz $2.50@2.60
Spring, Leach's Pat.....15%
Bemis & Call Co.'s Spring and Check..40%
Solid Tinners', P. S. & W. Co., ₱ doz $1.44, 55%
Tin'rs' Hollow Punches P. S. & W. Co.20&2%
Rice Hand Punches.....15%
Avery's Revolving.....40%
Avery's Saw-Set and Punch. See Saw Sets.

Rail—

Sliding Door, Wr't Brass, ₱ ₱ 35¢.....15%
Sliding Door, Bronzed Wr't Iron..₱ ft. 7¢
Sliding Door, Iron, Painted, ₱ foot 4¢, 40%
Barn Door Light. In. ½ ¾ 1
Per 100 feet.....$2.00 2.50 3.10, 10%
B. D. for N. E. Hangers—
Small. Med. Large.
Per 100 feet....$2.15 2.70 3.25..net
Terry's Steel Rail, ₱ foot.....4½¢
Victor Track Rail, 7¢ ₱ foot.....50&2%
Carrier Steel Rail, ₱ foot.....4½¢
Moore's Wrought Iron.....25%

Rakes—
Cast Steel, Association goods...66⅔&70%
Cast Steel, outside goods 60&10&10@70&5%
Malleable.....70@70&5%
Gibbs Lawn Rake.....$12.00, 50&15
Canton Lawn Rake.....$9.00, 50&10
Ft. Madison Prize Bow Brace and Peerless.....65%
Fort Madison Steel Tooth Lawn Rake, $6.00.....25%

Razors—
J. R. Torrey Razor Co.....20%
Wostenholme and Butcher, $10.00 to £, 10%
Jordan's AA A1, list Nov. 1, 1889.....50%
Jordan's Old Faithful, list Nov. 1, '89..50%
Electric.....List net

Razor Strops—See Strops, Razor.

Rings and Ringers.

Bull Rings—
Union Nut Co.....55%
Sargent's.....60%&10@70&5%
Hotchkiss' low list.....50%
Humason, Beckley & Co.'s.....70&10%
Peck, Stow & W. Co's..50&10@50&10&10%
Ellrich Hdw. Co., White Metal, low list. 50@50&10%

Hog—
Top of the Hill Ringers.....₱ doz $2.00
Top of the Hill Rings.....₱ doz $1.25
Hill's Improved Ringers.....₱ doz $4.25
Hill's Old Style Ringers.....₱ doz $2.75
Hill's Tongs.....₱ doz $4.50
Hill's Rings.....₱ doz bxs $2.15@2.25
Perfect Rings.....₱ doz bxs $1.60@1.70
Perfect Ringers.....₱ doz $2.15@2.25
Blair's Hog Ringers.....₱ doz $2.25@2.50
Blair's Hog Rings.....₱ doz 90¢@$1.00
Champion Ringers.....₱ doz $2.00
Champion Rings, Double.....₱ doz $2.25
Brown's Ringers.....₱ doz $2.00
Brown's Rings.....₱ doz $1.25@1.30

Rivets and Burrs—
Iron, list Nov. 17, '87.....40%
Copper.....50&10%
Coppered Iron, Bettina Brand.....40%

Rivet Sets—See Sets.

Rods—
Stair, Brass.....25&2%
Stair, Black Walnut.....₱ doz 40¢

Rollers—
Barn Door, Sargent's list.....60&10&10%
Acme Moore's Anti-Friction.....55%
Union Barn Door Roller.....70%

Rope—
Manufacturers' prices:
Manila...⅜ in. and larger ₱ ₱ 15 ¢
Manila.....⅜ in. ₱ ₱ 15½¢
Manila.....¼ and 5-16 in. ₱ ₱ 15½¢
Manila Tarred Rope.....₱ ₱ 14½¢
Manila, Hay Rope.....₱ ₱ 15 ¢
Sisal...⅜ inch and larger ₱ ₱ 10½¢
Sisal.....⅜ in. ₱ ₱ 10½¢
Sisal.....¼ and 5-16 in. ₱ ₱ 11 ¢
Sisal, Hay Rope.....₱ ₱ 10½¢
Sisal, Tarred Rope.....₱ ₱ 9½¢
Sisal, Medium Lathe Yarn.₱ ₱ 9½¢
New Zealand...⅜ in. and larger ₱ ₱ 9½¢
New Zealand.....⅜ inch, ₱ ₱ 9½¢
New Zealand.¼ and 5-16 inch, ₱ ₱ 10 ¢
New Zealand, Hay Rope.....₱ ₱ 9½¢
New Zealand, Tarred Rope....₱ ₱ 8½¢
Cotton Rope.....₱ ₱ 15@18¢ net
Jute Rope.....₱ ₱ 7½¢
1½% for cash in 10 days.

Wire—
List May 1, 1886.
Iron.....32½&2½%
Iron, Galvanized.....40&2½%
Cast Steel.....40&2½%

Rules—
Boxwood.....80&10&10@80&10&10&10%
Ivory.....50@50&10%
Starrett's Rules and Straight Edges, Steel.....25&10%

Sad Irons—See Irons, Sad.

Sand and Emery Paper and Cloth—See Paper and Cloth, Sand and Emery.

Sash Cord—See Cord, Sash.

Sash Locks—See Locks, Sash.

Sash Weights—See Weights, Sash.

Sausage Stuffers or Fillers—See Stuffers or Fillers, Sausage.

Saws—
Disston's Circular.....45%
Disston's Cross Cuts.....45%
Disston's Hand.....20%
Woodrough & McParlin.
Hand, Panel and Rip.....25%
Narrow Champion Cross Cuts with Handles, ₱ foot.....20¢
Champion Thin Back Cross Cuts, ₱ foot.....28¢
Champion Extra Thin Back Cross Cuts, ₱ foot.....31¢
One Man Champion Cross Cuts, ₱ foot.....40¢
Wheeler, Madden & Clemson Mfg. Co.
Hand, Panel and Rip.....30%
Narrow Champion Cross Cuts with Handles, ₱ foot.....20¢
Champion Thin Back Cross Cuts, ₱ foot.....28¢
Champion Extra Thin Back Cross Cuts, ₱ foot.....31¢
One Man Champion Cross Cuts, ₱ ft. 40¢

Atkins' Circular Shingle and Heading ... dis 50%
Atkins' Silver Steel Diamond X Cuts ... ₱ foot 70¢
Atkins' Special Steel Dexter X Cuts ... ₱ foot 50¢
Atkins' Special Steel Diamond X Cuts ... ₱ foot 32¢
Atkins' Champion and Electric Tooth X Cuts ... ₱ foot 30¢
Atkins' Hollow Back X Cuts ... ₱ foot 20¢
Atkins' Mulay, Mill and Drag ... 40%
Atkins' One-Man Saw, with handles, ₱ foot 40¢
Peace Circular and Mill ... 45%
Peace Hand Panel and Rip ... 25%
Peace Cross Cuts ... 45%
Richardson's Circular and Mill ... 45%
Richardson's X Cuts ... 45%
Richardson's Hand, &c ... 25%

Hack Saws—

Griffin's, complete ... 40&10@50%
Griffin's Hack Saw, Blades ... 40&10@50%
Star Hack Saws and Blades ... 25%
Eureka and Crescent ... 25%

Scroll—

Lester, complete, $10.00 ... 25%
Rogers, complete, $4.00 ... 25%
Barnes' Builders' and Cabinet Makers', $15 ... 25%
Barnes' Scroll Saw Blades ... 35%

Saw Frames—See Frames, Saw.

Saw Sets—See Sets, Saw.

Saw Tools—See Tools, Saw.

Scales—

Hatch, Counter, No. 171, good quality, ₱ doz $21.00
Hatch, Tea, No. 161 ... ₱ doz $6.75@$7.00
Union Platform, Plain ... $2.10@2.20
Union Platform, Striped ... $2.20@2.30
Chatillon's Grocers' Trip Scales ... 50%
Chatillon's Eureka ... 25%
Chatillon's Favorite ... 40%
Family, Turnbulls ... 30@50&10%
Riehle Bros.' Platform ... 40%

Scale Beams—See Beams, Scale

Scissors, Fluting ... 45%

Scrapers—

Adjustable Box Scraper (S. R. & L. Co.) $6.50 ... 30&10%
Box, 1 Handle ... ₱ doz $4.00, 10%
Box, 2 Handle ... ₱ doz $6.00, 10%
Defiance Box and Ship ... 20&10%
Foot ... 50&10@65%
Ship, Common ... ₱ doz $3.50 net
Ship, R. I. Tool Co ... 10%

Screen Window and Door Frames—See Frames.

Screw Drivers—See Drivers, Screw.

Screws.

Bench and Hand—

Bench, Iron ... 55&10@55&10&10%
Bench, Wood, Beech ... ₱ doz $2.25
Bench, Wood, Hickory ... 20&10%
Hand, Wood ... 25&10@25&10&5%
Lag, Blunt Point, list Jan. 1, 1890 ... 75&10%
Coach and Lag, Gimlet Point, list Jan. 1, 1890 ... 75@75&10%
Bed ... 25&5%
Hand Rail, Sargent's ... 66⅔&10%
Hand Rail, H. & B. Mfg. Co ... 70&10@75%
Hand Rail, Am. Screw Co ... 75%
Jack Screws, Millers Falls list ... 50@50&5%
Jack Screws, P. S. & W ... 35%
Jack Screws, Sargent ... 60&10@60&10&5%
Jack Screws Stearns' ... 40@40&10%

Cork—

Humason & Beckley Mfg. Co ... 40&10@50%
Williamson's ... 33⅓@33⅓&5%
Howe Bros & Hulbert ... 35%

Machine—

Flat Head, Iron ... 55%
Round Head, Iron ... 50%

Wood—

List March 1, 1889.
Flat Head Iron ... 50%
Round Head Iron ... 40%
Flat Head Brass ... 45%
Round Head Brass ... 35%
Flat Head Bronze ... 45%
Round Head Bronze ... 35%
Extra 10 @ 10&5 % often given
Rogers' Drive Screws ... 66⅔%

Scroll Saws—See Saws, Scroll.

Scythe Snaths—See Snaths, Scythe.

Sets.

Awl and Tool.

Aiken's Sets, Awls and Tools, No. 20, ₱ doz $10.00 ... 55&10%
Fray's Adj. Tool Hdls., Nos. 1, $12; 2, $18; 3, $12; 4, $9 ... 25@25&10%
Miller's Falls Adj. Tool Hdls., Nos. 1, $12, 2, $18 ... 25%
Henry's Combination Haft ... ₱ doz $6.50
Brad Sets, No. 42, $10.50; No. 48, $12.50 ... 70&10&5%
Stanley's Excelsior: No. 1, $7.50; No. 2, $4.00; No. 3, $5.50 ... 30&10%

Nail—

Square ... ₱ gr., $4.00@$4.25
Round ... ₱ gr. $3.25
Buck Bros ... 27½%
Cannon's Diamond Point ... ₱ gr., $12, 20%

Rivet.

Regular list ... 50&10%

Saw—

Stillman's Genuine ... ₱ doz $5.00@7.75, 40&5%
Stillman's Imita ... ₱ doz $3.25@5.25, 40&5@40&10%
Common Lever ... ₱ doz $2.00, 40&5%
Morrill's No. 1, $15.00; Nos. 3&4, $24.00, 40&10@50%
Leach's ... No. 0, $8.00; No. 1, $15, 15@20%
Nash's ... 20&10@20&10&10%
Hammer, Hotchkiss ... $5.50, 10%
Hammer, Bemis & Call Co.'s new Pat., 30&5%
Bemis & Call Co.'s Lever and Spring Hammer ... 30&5%
Bemis & Call Co.'s Plate ... 10%
Bemis & Call Co.'s Cross Cut ... 12½%
Aiken's Genuine ... $13.00, 50&10%
Aiken's Imitation ... $7.00, 55&5%
Hart's Pat. Lever ... 20%
Disston's Star ... 25%
Leopold ... 40&10@50%
Atkin's Lever ... ₱ doz No. 1, $6.00
Atkin's Criterion ... ₱ doz No. 1, $6.00
Croissant (Keller), No. 1, $15.00; No. 2, $24.00 ... 40&10%
Avery's Saw Set and Punch ... 50%
Chieftain H. R. Co.'s Superior ... ₱ doz $15, 50%

Sharpeners, Knife.

Parkin s.
Applewood Handles ... ₱ doz $6.00, 40%
Rosewood or Cocobolo ... ₱ doz $9.00, 40%

Shaves, Spoke.

Iron ... 45%
Wood ... 30%
Bailey's (Stanley R. & L. Co.) ... 40&10%
Stearns' ... 30&10%
Cincinnati ... 25&10%

Shears—

American (Cast) Iron ... 75&10@75&10&5%
Barnard's Lamp Trimmers ... ₱ doz $3.75
Tinners' ... 20&2%
Seymour's, List, Dec., 1881, 60&10&10@60&10&10&5%
Heinisch's, List, Dec., 1881, 60&10&10@60&10&10&5%
Heinisch's Tailor's Shears ... 33⅓%
First quality C. S. Trimmers ... 80@80&10%
Second quality C. S. Trimmers, 80&10@80&10&10%
Acme Cast Shears ... 10&10%
Diamond Cast Shears ... 10%
Clipper ... 10&10%
Victor Cast Shears ... 75&10@75&10&5%
Howe Bros. & Hulbert, Solid Forged Steel ... 40%
Chicago Drop Forge & F. Co., Solid Steel Forged ... 60%
Clauss Shear Co., Japanned ... 70%
Clauss Shear Co., Nickeled, same list, 60%
Electric ... List net

Pruning Shears and Hooks.

Disston's Combined Pruning Hook and Saw ... ₱ doz $18.00, 20&10%
Disston's Pruning Hook, ₱ doz $12.00, 20&10%
E. S. Lee & Co.'s Pruning Tools ... 40%
Pruning Shears, Henry's Pat, ₱ doz. $3.75@4.00 net
Henry's Pruning Shears, ₱ doz $4.25@4.50 net
Wheeler, M. & C. Co.'s Combination, ₱ doz $12.00, 20%
Dunlap's Saw and Chisel, ₱ doz $8.50, 30%
J. Mallinson & Co., No. 1, $5.25; No. 2 7.25
P., S. & W. Co ... 60%

Tinners', &c.—

Shears and Snips (P. S. & W.) ... 20@25%
Snips, J. Mallinson & Co ... 33⅓%

Sheaves—

Sliding Door—

M. W. Co., list July, 1888 ... 50&10@60&5%
R. & E., list Dec. 18, 1885 ... 55&20%
Corbin's list ... 60&10&2%
Patent Roller ... 60&10&2%
Patent Roller, Hatfield's ... 75%
Russell's Anti-Friction, list Dec. 18, 1885 ... 60&2%
Moore's Anti-Friction ... 50%

Sliding Shutter—

R. & E. list Dec. 18, 1885 ... 60&10&2%
Sargent's list ... 60&10%
Reading list ... 60&10&10%

Ship Tools—

L. & I. J. White ... 20&5%

Shoes, Horse, Mule, &c.—

Horse—

Burden's, Perkins', Phoenix, at factory, $4.00

Mule—

Add $1 ₱ keg to above prices.

Ox, Wrought—

Ton lots ... ₱ ℔ 9¢
1000 ℔ lots ... ₱ ℔ 9½¢
500 ℔ lots ... ₱ ℔ 10¢

Shot—

(Eastern prices 2¢ off, cash, 5 days.

Drop, ₱ bag, 25 ℔ ... $1.62
Drop, ₱ bag, 5 ℔ ... .38
Buck and Chilled, ₱ 25-℔ bag ... 1.87
Buck and Chilled, ₱ 5-℔ bag ... .45

Shovels and Spades—

Ames' Shovels, Spades, &c., list Nov. 1, 1885 ... 20%
NOTE.—Jobbers frequently give 5@7½% extra on above.
Griffith's Black Iron ... 50&10%
Griffith's C. S. ... 60@60&10%
Griffith's Solid C. S. R. R. Goods ... 20%
Old Colony (Sanford Fork & Tool Co.) 35%
St. Louis Shovel Co ... 20@20&7½%
Hussey, Binns & Co ... 15@25%
Hubbard & Co ... 20@20&7½%
Lehigh Mfg. Co ... 50&10%
Payne Pettebone & Son, list January, 1886 ... 30%
Remington's (Lowman's Pat.) 30&10@40%
Rowland's, Black Iron ... 50&10%
Rowland's Steel ... 60&5@60&10%

Shovels and Tongs—

Iron Head ... 60&10@60&10&5%
Brass Head ... 60&10&10%

Sieves—

Mann's Tin Rim ... 50&25%
Buffalo Metallic, S. S. & Co ... 50&25%
Shaker (Barler's Pat.) Flour Sifters, ₱ doz $2.00; ₱ gr $21.60
Electric ... ₱ gr $21.00
A. & W. Sifters ... ₱ doz 2.00
Hunter's ... ₱ doz $2.00
Smith's Adjustable Sifters ... ₱ doz $2.00
Smith's Adjustable Milk Strainer, ₱ doz $2.00
Smith's Adjustable T. & C. Strainer, ₱ doz. $1.25

Sieves, Wooden Rim—

	Iron.	Plated.
Mesh 18, Nested, ₱ doz..	80¢	$1.00
Mesh 20, Nested, ₱ doz..	90¢	1.10
Mesh 24, Nested, ₱ doz..	$1.15	1.25

Skeins, Thimble—

Western list ... 75&5@75&10%
Columbus Wrt. Steel. Special net prices
Coldbrookdale Iron Co ... 60%
Utica P. S. T. Skeins ... 60%
Utica Turned and Fitted ... 35%

Slates—

School, by case ... 50@50&10%

Snaps, Harness, &c.—

Anchor (T. & S. Mfg. Co.) ... 65%
Fitch's (Bristol) ... 50&10%
Hotchkiss ... 10%
Andrews ... 50%
Sargent's Patent Guarded ... 70&10&10%
German, new list ... 40&10%
Covert ... 50&2%
Covert, New Patent ... 50&5&2%
Covert, New R. B ... 60&2%
Covered Spring ... 60&10&10%

Snaths, Scythe.

List ... 50&10@50&10&5%

Soldering Irons—See Irons, Soldering.

Spittoons, Cuspidors, &c.

Standard Fiberware—

Cuspidors, 8½-inch, ₱ doz., No. 5, $8; No. 5X $9.
Spittoons, Daisy, 8-inch, No. 1, $4; 10 and 11 inch, $6.

Spoke Shaves—See Shaves, Spoke.

Spoke Trimmers—See Trimmers, Spoke.

Spoons and Forks—

Tinned Iron—

Basting, Cen. Stamp. Co.'s list ... 70&10%
Solid Table and Tea, Cen. Stamp. Co.'s list ... 70&10%
Buffalo S. S. & Co ... 33⅓&2%

Silver-Plated—(4 mos. or 5% cash 30 days).

Meriden Brit. Co., Rogers ... 40&15%
C. Rogers & Bros ... 40&15%
Rogers & Bro ... 40&15%
Reed & Barton ... 40@40&5%
Wm. Rogers Mfg. Co ... 40, 15&5%
Simpson, Hall, Miller & Co ... 40, 15&5%
Holmes & Edwards Silver Co ... 40, 15&5%
L. Boardman & Son ... 50&12½%

Miscellaneous.

Holmes & Edwards Silver Co.:
No. 67 Mexican Silver ... 50&10&5%
No. 30 Silver Metal ... 50&10&5%
No. 24 German Silver ... 50&10&5%
No. 50 Nickel Silver ... 50&5%
No. 49 Nickel Silver ... 50&10&5%
Wm. Rogers Mfg. Co.
Rogers' Silver Metal ... 50, 10&5%
18% Rogers' German Silver ... 60&5%
22% Rogers' Nickel Silver ... 50&5%
German Silver ... 50&50&5
German Silver, Hall & Elton ... 50&5% cash
Nickel Silver ... 50&5@50&10&5% cash
Britannia ... 50%
Boardman's N'ck'l Silver ... 40&7½&2½% cash
Boardman's Britannia spoons, case lots ... 50&12½&5% cash

Springs, Door.

Torrey's Rod, regular size ... ₱ doz $1.30
Gray's, ₱ gr., $20.00 ... 20%
Bee Rod ₱ gr., $20.00 ... 20%
Warner's No. 1, ₱ doz, $2.50; No. 2, $3.30 ... 40&10@50%
Gem (Coil), list April 19, 1886 ... 10%
Star (Coil), list April 19, 1886 ... 20%
Victor (Coil) ... 60@60&10%
Champion (Coil) ... 60&10@60&10&10%
Philadelphia, 5 in., $5.00; 8 in., $7.75.. %
Cowell's ... No. 1, ₱ doz, $18.00; No. 2, $15.00 ... 50%
Rubber, complete, ₱ doz, $4.50 ... 55&10%
Hercules ... 50%
Shaw Door Check and Spring ... 25@30@35%
Elliptic, Concord, Platform and Half Scroll ... 60@60&5%
Cliff's Bolster Springs ... 25%

Squares—

Steel and Iron } ... 80 &10%
Nickel-Plated } ... 80 &10%
Try Square and T Bevels ... 60&10@60&10 &10%
Disston's Try Square and T Bevels ... 50%
Winterbottom's Try and Miter ... 30&10%
Starrett's Micrometer Caliper Squares ... 25%
Avery's Flush Bevel Squares ... 40%
Avery's Bevel Protractor ... 50%

Squeezers.

Fodder.—

Blair's ... ₱ doz $2.00
Blair's "Climax" ... ₱ doz $1.25

Lemon—

Porcelain Lined, No. 1 ... ₱ doz $6.00, 25&20%
Wood, No. 2 ... ₱ doz $3.00, 35%
Wood, Common ... ₱ doz $1.70@1.75
Dunlap's Improved ... ₱ doz $3.75, 20%
Sammis ... No. 1, $6.00; No. 2, $9; 12, $18 ₱ doz ... 25&10%
Jennings' Star ... ₱ doz $2.50
The Boss ... ₱ doz $2.50
Dean's ... Nos. 1, ₱ doz $6.50; 2, $3.35; 3, $1.90; Queen, $2.50
Little Giant ... 60&50&5%
King ... 40&5%
Hotchkiss Straight Flash ... ₱ doz $12.00
Silver & Co., Glass ... ₱ gro. $9.00

Standard Fiber Ware—See Ware, Standard Fiber.

Staples.

Blind—

Barbed, ½ in. and larger ... ₱ ℔ 7@7½¢
Barbed, ⅜ in ... ₱ ℔ 8@8½¢
Fence Staples, Galvanized, } Same price as Brb Wire, See Trd. Rep.
Fence Staples, Plain ... }

Steelyards ... 40&10@50%

Stocks and Dies—

Blacksmith's
Waterford Goods ... 40@40&10%
Butterfield's Goods ... 40@40&10%
Lightning Screw Plate ... 25@30%
Reece's New Screw Plates ... 35%&5@40%
Reversible Ratchet ... 30%
Gardner ... 25%

Stops, Bench.

Morrill's ... ₱ doz $9, 50%
Hotchkiss's ... ₱ doz $5, 10@10&10%
Weston's, No. 1, $10; No. 2, $9.25&10@5%
McGill's ... ₱ doz $3 ... 10%
Cincinnati ... 25&10%

Stone—

Hindostan No. 1, 3¢; Axe, 3½¢; Slips No. 1, 4½¢
Sand Stone ... ₱ ℔ 3½¢
Washita Stone, Extra ... ₱ ℔ 20@21¢
Washita Stone, No. 1 ... ₱ ℔ 15@16¢
Washita Stone, No. 2 ... ₱ ℔ 11@12¢
Washita Slips, No. 1, Extra ... ₱ ℔ 37@40¢
Washita Slips, No. 1 ... ₱ ℔ 25@26¢
Arkansas Stone, No. 1, 4 to 6 in ... ₱ ℔ $1.50
Arkansas Stone, No. 1, 6 to 9 in ... ₱ ℔ $1.85
Turkey Oil Stone, 4 to 8 in ... ₱ ℔ 40¢
Turkey Slips ... ₱ ℔ $1.00@1.50
Lake Superior, Chase ... ₱ ℔ 16¢
Lake Superior Slips, Chase ... ₱ ℔ 31@32¢
Seneca Stone, Red Paper Brand ... ₱ ℔ 18@20¢
Seneca Stone, High Rounds ... ₱ ℔ 20@25¢
Seneca Stone, Small Wheels ... ₱ gro $24.00

Stove Polish—See Polish, Stove.

Stretchers, Carpet.

Cast Steel, Polished ... ₱ doz $2.25
Cast Iron, Steel Points ... ₱ doz 80¢
Socket ... ₱ doz $1.75
Millard's ... 25@25&10%

Strops, Razor—

Genuine Emerson ... 60@60&5%
Imitation " ... ₱ doz $2.00, 20&10&5%
Torrey's ... 20%
Badger's Belt and Com ... ₱ doz $2.00
Lamont Combination ... ₱ doz $4.00
Jordan's Pat. Padded, list Nov. 1, '89 ... 50%
Electric ... List net

Stuffers or Fillers, Sausage—

Miles' "Challenge," ₱ doz $20, 50@50&5%
Perry ... ₱ doz, No. 1, $15.00; No. 0, $21.00 ... 50&5@50&10%
Draw Cut No. 4, each $30.00 ... 20%
Enterprise Mfg. Co ... 20&10@30%
Silver's ... 40&10%

Sweepers, Carpet.

Bissell No. 5 ... ₱ doz $17.00
Bissell No. 7 New Drop Pan ... ₱ doz $19.00
Bissell, Grand ... ₱ doz $36.00
Grand Rapids ... ₱ doz $24.00
Crown Jewel, No. 1, $18.00; No. 2, $19.00; No. 3, $20.00
Magic ... ₱ doz $15.00
Jewel ... ₱ doz $17.00
Improved Parlor Queen, Nickeled ... ₱ doz $27.00
Japanned ... ₱ doz $24.00
Excelsior ... ₱ doz $22.00
Garland ... ₱ doz $18.00
Parlor Queen ... ₱ doz $24.00
Housewife's Delight ... ₱ doz $15.00
Queen ... ₱ doz $16.00
Queen, with band ... ₱ doz $18.00
Ring ... ₱ doz $30.00
Weed, Improved ... ₱ doz $18.00
Hub ... ₱ doz $16.00
Cog-Wheel ... ₱ doz $16.00
Conqueror ... ₱ doz $22.00
Easy ... ₱ doz $22.00
Monarch ... ₱ doz $22.00
Goshen ... ₱ doz $21.00

Tacks, Brads, &c.—

List Oct. 19, 1889. Standard Weights.

Carpet Tacks—
American Iron, Blued ... 77½%
American Iron, Tin'd or Cop'd ... 77½%
Steel, Plain or Bright ... 75%
Steel, Tinned or Coppered ... 75%
Swedes Iron, Blued ... 75%
Swedes Iron, Tinned or Cop'd ... 75%
American Iron Cut Tacks ... 75%
Swedes Ir. Uphol'rs' Tacks, Blued ... 75%
Swedes Iron Upholsterers' Tacks, Tinned ... 77½%
Gimp and Lace Tacks, Blued ... 75%
Gimp and Lace Tacks, Tinned ... 77½%
Swedes Iron Basket or Trimmers' Tacks ... 70&10%
Miners' Tacks ... 77½%
Bill-Posters' or Railroad Tacks ... 75%
Bill-Posters' or Railroad Tacks, Tinned ... 77½%
Copper Tacks ... 40%
Copper Finish. & Trunk Nails ... 40%
Cigar Box Nails ... 60%
Zinc Glaziers' Points ... 50%
Picture-Frame Points ... 50%
Looking-Glass Tacks ... 50%
Brush Tacks ... 60%
Tin-Capped Trunk Nails ... 60%
Finishing Nails ... 70%
Trunk and Clout Nails, Black and Tinned ... 72½%
Common and Patent Brads ... 70%
Hungarian Nails ... 70%
Basket and Chair Nails ... 65%
Leathered Carpet Tacks ... 40%

Miscellaneous—

Double-Pointed ... 82½%
Wire Carpet Nails ... 80&10%
Plymouth Rock Steel Carpet Tacks ... 25

Extra 10 @ 10&10%

Wire Brads & Nails, see Nails, Wire.
Steel-Wire Brads, R. & E. Mfg. Co.'s list.....50&10%

Tapes, Measuring—

American.....40@40&5%
Spring.....40%
Chesterman's, Regular list.....35@30%

Thermometers—

Tin Case.....80@80&10%

Thimble Skeins—See Skeins.

Ties, Bale— Steel

Standard Wire, list.....50&10&5%

Tinners' Shears, &c.—See Shears, Tinners', &c.

Tinware—

Stamped, Japanned and Pieced, list Jan. 20 1887.....70&10@70&10&5%

Tire Benders, Upsetters, &c—
See Benders and Upsetters, Tire.

Tools.

Coopers'—

Bradley's.....20%
Barton's.....20@20&5%
L. & I. J. White.....20&5%
Albertson Mfg. Co.....25%
Beatty's.....30%
Sandusky Tool Co.....30@30&5%
Shaves, Cincinnati Tool Co.....20%

Lumber.

Ring Peavies, "Blue Line"...₱ doz $20.00
Ring Peavies, Common.....₱ doz $18.00
Steel Socket Peavies.....₱ doz $21.00
Mall. Iron Socket Peavies....₱ doz $19.00
Cant Hooks, "Blue Line"..₱ doz $16.00
Cant Hooks, Common Finish..₱ doz $14.00
Cant Hooks, Mall. Socket Clasp, "Blue Line" Finish.....$16.00
Cant Hooks, Mall. Socket Clasp, Common Finish.....₱ doz $14.50
Cant Hooks, Clip Clasp, "Blue Line" Finish.....₱ doz $14.00
Cant Hooks, Clip Clasp, Common Finish.....₱ doz $12.00
Hand Spikes....₱ doz 6 ft., $15.00; 8 ft., $20.00
Pike Poles, Pike & Hook, ₱ doz., 12 ft., $11.50; 14 ft., $12.50; 16 ft., $14.50; 18 ft., $17.50; 20 ft., $21.50.
Pike Poles, Pike only, ₱ doz, 12 ft., $10.00; 14 ft., $11.00; 16 ft., $13.00; 18 ft., $16.00; 20 ft., $20.00.
Pike Poles, not ironed, ₱ doz, 12 ft. $6.00; 14 ft., $7.00; 16 ft., $9.00; 18 ft., $12.00; 20 ft., $16.00.
Setting Poles, ₱ doz, 12 ft., $14.00; 14 ft., $15.00; 16 ft., $17.00
Swamp Hooks.....₱ doz $18.00

Saw.

Atkins' Perfection.....₱ doz $12.00
Atkins' Excelsior.....₱ doz $6.00
Atkins' Giant.....₱ doz $4.00

Tobacco Cutters—See Cutters, Tobacco.

Transom Lifters — See Lifters, Transom.

Traps—

Game—

Newhouse.....40@40&5%
Oneida Pattern.....70&10%
Game, Blake's Patent.....40&10&5%

Mouse and Rat—

Mouse Wood, Choker, ₱ doz holes, 11@12¢
Mouse, Round Wire.....₱ doz $1.50, 10%
Mouse, Cage, Wire.....₱ doz $2.50, 10%
Mouse, Catch-'em-alive....₱ dz $2.50 15%
Mouse, Bonanza.....₱ doz $0.90@$1.00
Mouse, Delusion.....₱ $1.00@$1.25
Rat, Decoy.....₱ gr $10.00, 10%
Ideal.....₱ gr $10.00
Cyclone.....₱ gr $5.25
Hotchkiss Metallic Mouse, 5-hole traps, ₱ doz., 90¢; in full cases, ₱ doz.....75¢
Hotchkiss Imp. Rat Killer..₱ gro $18.50
Hochkiss New Rat Killer...₱ gro $16.50
Schuyler's Rat Killer.....₱ gro $15.00

Triers—

Butter and cheese.....25%

Trimmers, Spoke.

Bonney's.....₱ doz $10.00, 50%
Stearns'.....20&10%
Ives', No. 1, $15.00; No. 2, $12.00 ₱ doz. 55&10%
Douglas'.....₱ doz $9.00, 20%
Cincinnati.....25%

Trowels—

Lothrop's Brick and Plastering, 20&10&5@35%
Reed's Brick and Plastering.....15%
Disston's Br'k and Plastering.....25%
Pease's Plastering.....25%
Clement & Maynard's.....20%
Rose's Brick.....15@20%
Brade's Brick.....25%
Worrall's Brick and Plastering.....20%
Garden.....70%

Trucks, Warehouse, &c.—

B. & L. Block Co.'s list, '82.....40%

Tubes, Boiler—
See Pipe.

Twine—

Flax Twine—	BC.	B.
No. 9, ¼ and ½ ℔ Balls	26¢	34¢
No. 12, ¼ and ½ ℔ Balls	25¢	33¢
No. 18, ¼ and ½ ℔ Balls	22¢	32¢
No. 24, ¼ and ½ ℔ Balls	22¢	32¢
No. 36, ¼ and ½ ℔ Balls	20¢	31¢

No. 264, Mattrass, ¼ and ½ ℔ Balls.52@54¢
Chalk Line, Cotton, ½ ℔ Balls.....25¢
Mason Line, Linen, ½ ℔ Balls.....55¢
2-Ply Hemp, ¼ and ½ ℔ Balls (Spring Twine).....15½¢
3-Ply Hemp, 1 ℔ Balls.....16¢@16½¢
3-Ply Hemp, 1½ ℔ Balls.....15¢@15½¢
Cotton Wrapping, 5 Balls to ℔..15¢@16¢
2, 3, 4 and 5-Ply Jute, ½ ℔ Balls.....10¢
Wool.....6½¢@6½¢
Paper.....13¢@14¢
Cotton Mops, 6, 9, 12 and 15 ℔ to doz..18¢

Vises—

Solid Box.....50&10@50&10&5%

Parallel—

Fisher & Norris Double Screw.....15&10%
Stephens'.....25@30%
Parker's.....20@25%
Wilson's.....55%
Howard's.....40%
Bonney's.....40&10%
Millers Falls.....40@40&10%
Trenton.....40@5@40&10%
Merrill's.....15@20%
Sargent's.....60&10&10%
Backus and Union.....40%
Double Screw Leg.....15&10%
Prentiss.....20@25%
Simpson's Adjustable.....40%
Moore's.....20%

Saw Filers—

Bonney's, Nos. 2 & 3, $15.00.....40&10%
Stearn's.....33⅓&10@33⅓&10&10%
Stearn's Silent Saw Vises.....33⅓@35%
Sargent's.....60%&10%
Hopkins'.....₱ doz $17.50, 10%
Reading.....40&10%
Wentworth.....20&10%

Miscellaneous.

Combination Hand Vises.....₱ gr $42.00
Cowell Hand Vises.....20%
Bauer's Pipe Vises.....10%
Cincinnati.....25&10%
Enterprise Pipe Vises, each.....$3.00

Wagon Boxes—See Boxes, Wagon.

Washer Cutters—See Cutters Washer.

Wagon Jacks—See Jacks, Wagon.

Ware, Hollow, Enameled, &c.

Cast Iron, Hollow—

Stove Hollow-Ware—
Ground.....55&5@60&5%
Unground.....65&10@65&10&5%
White Enameled-Ware—
Maslin Kettles.....60&10&5%
Boilers and Saucepans.....40%
Tinned Boilers and Saucepans.....40%
Rustless Hollow-Ware.....50@50&5%
Gray Enameled-Ware—
Stove.....50%
Maslin Kettles.....60&10&10%
Boilers and Saucepans.....40&5%

Enameled—

Agate and Granite Ware, list Jan. 1, 1889.....33⅓&10%
Ironclad Enameled Ware...dis 33⅓&10%

Kettles—

Galvanized Tea-Kettles—

Inch....	6	7	8	9
Each....	55¢	60¢	65¢	75¢

Standard Fiber—

	Per Dozen. Plain.	Dec'r'd
Wash-Basins, 10½ in.....	$2.00	$2.25
Wash-Basins, 12 in.....	2.25	2.75
Keelers, 11½ in.....		4.00
Cuspidors.....		8.00
Spittoons, "Daisy," 8 in....	4.00	4.50
Peck Measure.....	4.00	
Half-peck Measure.....	3.50	

See also Pails.

Indurated Fiber—25%

Spittoons, No. 2, ₱ doz.....$9.00
Basins, Ringed, ₱ doz., No. 2, $4.80; No. 3.....$4.20
Washtubs, Nested, Nos. 0, 1, 2 and 3 (4 pieces), ₱ nest.....$7.50
Keelers, Nested, Nos. 1, 2, 3 and 4 (4 pieces), ₱ nest.....$2.25
Butter Bowls 15, 17 and 19-inch (3 pieces), ₱ nest.....$3.70
Liquid Measures, pt., qt., 2 qt. and funnell (4 pieces) ₱ set.....$7.00
Dry Measures, 1, 2, 4, 8 and 16 qts. (5 pieces), ₱ set.....$3 00
See also *Pails.*

Silver Plated, Hollow—
4 mo. or 5 % cash in 30 days.

Reed & Barton.....
Meriden Britannia Co.....
Simpson, Hall, Miller & Co.....
Rogers & Brother.....
} 40&5%

Hartford Silver Plate Co.....
William Rogers Mfg. Co.....
} 40&5&5%

Washers—

Size.....	¼	5-16	⅜	½	⅝	¾	1
Washers....	6¾	5½	4½	3½	3	3	3

In lots less than 200 ℔, ₱ ℔, add ¼¢, 5-2 boxes 1¢ to list.

Wedges—

Iron.....₱ ℔ 3½¢
Steel.....₱ ℔ 4 ¢

Weights, Sash—

Solid Eyes.....₱ ton $18@$19

Well Buckets, Galvanized—See Buckets, Well, Galvanized.

Wheels, Well.

8 in., $2.25; 10 in., $2.70; 12 in., $3.25

Wire and Wire Goods—

Iron—

Market.
Br. & Ann., Nos. 0 to 18.....72½%
Cop'd, Nos. 0 to 18.....70%
Galv., Nos. 0 to 18.....62½%
Tin'd, Tinned list Nos. 0 to 18.....62½%
Stone,
Br. and Ann'd, Nos. 16 to 18....72½%
Bright and Ann'd, Nos. 19 to 26.... 75%
Br. and Ann'd, Nos. 27 to 36.....77½%
Tinned.....
Tinned Broom Wire, 18 to 21, ₱ ℔...5½¢
Galvanized Fence, Nos. 8 and 9.....65%
Annealed Fence, Nos. 8 and 9.....75%
Annealed Grave, Nos. 10 to 14.....75%
Brass, list Jan. 18, 1884.....35%
Copper, list Jan. 18, 1884.....35%
Barb Fence.....See Trade Report
Annealed Wire on Spools.....50%
Malin's Steel and Tin'd on Spools.....50%
Malin's Brass and Cop. on Spools.....40%
Cast Steel Wire.....50%
Stubs' Steel Wire.....$6.00 to 2, 30%
Steel Music Wire, Nos. 12 to 30..55¢ ₱ ℔
Picture Wire..... New list 50%
Wire Clothes Lines, see Lines.

Bright Wire Goods—

Standard list.....85%

Wire Cloth and Netting.

Painted Screen Cloth, good quality, ₱ 100 sq. ft., $1.60 @ $1.75
Galvanized Wire Netting.....70&10@75%

Wire Rope—See Rope, Wire.

Wrenches—

American Adjustable.....40%
Baxter's Adjustable "S".....40&10@50%
Baxter's Diagonal.....40&10@50%
Coes' Genuine.....50&3%
Coes' "Mechanics'".....50&10&3%
Girard Standard.....65&10%
Lamson & Sessions' Engineers'..60&10%
Lamson & Sessions' Standard...70&10%
P. S. & W. Agricultural....
Girard Agricultural.....
Lamson & Sessions' Agric'l..
} 75@77&10

Bemis & Call's
Pat. Combination.....35%
Merrick's Pattern.....35%
Brigg's Pattern.....25%
Cylinder or Gas Pipe.....40&5%
No. 3 Pipe.....40&10%
Aiken's Pocket (Bright).....$6.00, 50&10%
The Favorite Pocket.....₱ doz $4.00, 40%
Webster's Pat. Combination.....25%
Boardman's.....20&10%
Always Ready.....25&5%
Alligator.....50%
Donohue's Engineer.....20&10%
Acme, Bright.....50&2%
Acme, Nickeled.....40&2%
Walker's.....65&2%
Diamond Steel.....55&3%
Cincinnati Brace Wrenches.....25&10%
Tafts' Vise Wrench.....55&10&3%

Wringers, Clothes—

List March 11, 1889, 2% cash.

Wrought Goods—

Staples, Hooks, &c., list Jan. 12, 1886, 80&15@85%

PAINTS, OILS AND COLORS.—Wholesale Prices.

Animal and Vegetable Oils.

Linseed, City, raw..per gal.	62	@	64
Linseed, City, boiled.....	65	@	67
Linseed, Western, raw.....	..	@	60
Lard, City, Extra Winter..	53	@	54
Lard, City, Prime.....	51	@	52
Lard, City, Extra No. 1.....	45	@	46
Lard, City, No. 1.....	42	@	43
Lard, Western, prime.....	51	@	52
Cotton-seed, Crude, prime.	26	@	27
Cotton-seed, Crude, off grades.....	22	@	25
Cotton-seed, Summer Yellow, prime.....	32½	@	33
Cottonseed, Summer Yellow, off grades.....	30	@	32
Sperm, Crude.....	67	@	70
Sperm, Natural Spring.....	..	@	68
Sperm, Bleached Spring.....	..	@	73
Sperm, Natural Winter.....	..	@	78
Sperm, Bleached Winter...	80	@	81
Whale, Crude.....	..	@	..
Whale, Natural Winter.....	..	@	51
Whale, Bleached Winter...	..	@	53
Whale, Extra Bleached.....	56	@	..
Sea Elephant, Bleached Winter.....	60	@	62
Menhaden, Crude, Sound...	19	@	22
Menhaden, Crude, Southern	..	@	..
Menhaden, Light Pressed..	24	@	25
Menhaden, Bleached W'ter.	31	@	32
Menhaden, Extra Bleached	35	@	..
Tallow, City, prime.....	..	@	45
Tallow, Western, prime....	..	@	..
Cocoanut, Ceylon.....	7¾	@	8
Cocoanut, Cochin.....	..	@	8¼
Cod, Domestic.....	31	@	32
Cod, Foreign.....	33	@	34
Red Elaine.....	31	@	34
Red Saponified..... ₱ ℔	4¾	@	5
Bank.....per gal	24	@	..
Straits.....	25	@	..
Olive, Italian, bbls.....	72	@	..
Neatsfoot, prime.....	62½	@	75
Palm, prime, Lagos....₱ ℔	6½	@	7

Mineral Oils.

Black, 29 gravity, 25 @ 30 cold test.....per gal	8¼	@	9
Black, 29 gravity, 15 cold test.....	9	@	9½
Black, 29 gravity, summer.	7	@	8
Cylinder, light, filtered.....	15	@	20
Cylinder, dark, filtered.....	14	@	20
Cylinder, dard, st'm refined	10	@	18
Paraffine, 23½ @ 24 gravity.	12½	@	13
Paraffine, 25 gravity.....	11½	@	12
Paraffine, 28 gravity.....	10½	@	11
Paraffine, red, 21 @ 22 gr'ty	..	@	14½
Paraffine, red, 22½ @ 23 gr'ty	17½	@	18

Paints and Colors.

Barytes, Prime White..... ₱ ton.	$21.00	@	$22.50
Barytes, Amer. refined...	20.00	@	....
Barytes, Amer. No. 1.....	18.00	@	....
Barytes, Amer. No. 2.....	16.00	@	....
Barytes, Amer., off-color.	13.00	@	15.00
Blue, Celestial..... ₱ ℔	6	@	8
Blue, Chinese	50	@	55
Blue, Prussian.....	25	@	40
Blue, Ultramarine.....	10	@	30
Brown, Spanish.....	½	@	1
Brown, Vandyke, Amber....	3	@	3½
Brown, Vandyke, English .	6	@	8
Black, American Drop....	8	@	10
Black, English Drop.....	12	@	14
Black, Frankfort, Drop...	5	@	18
Black, Lamp, common....	12	@	18
Black, Lamp, medium.....	19	@	25
Black, Lamp, prime.....	27	@	33
Carmine, No. 40, in bulk.	3.10	@	..
Carmine, No. 40, in boxes or barrels.....	3.20	@	..
Carmine, No. 40, in ounce bottles.....	4.20	@	..
Chalk, in bulk.... ₱ ton.	2.50	@	2.75
Chalk, in bbls.. ₱ 100 ℔	30	@	35
China Clay, English..... ₱ ton.	13.50	@	18.00
China Clay, Southern....	10.00	@	12.00
Cobalt Oxide, prep'd....	2.90	@	....
Cobalt Oxide, black, lots 100 ℔.	2.60	@	....
Cobalt, Oxide, black, less 100 ℔.	2.65	@	....
Crocus Martus, Engl. ₱ ℔.	1½	@	2½
Crocus, American	1½	@	2½
Green, Paris, in bulk.....	14	@	14½
Green, Paris, 170 @ 175 ℔ kegs.....	14½	@	15
Green, Paris, small pack.	16	@	21
Green, Chrome, ordinary	8	@	13
Green, Chrome, pure....	22	@	25
Lead, Eng., B.B. white....	9	@	10
Lead, Amn. White, dry or in oil:			
Kegs, lots less than 1000 ℔..		@	7½
Kegs, lots 1000 ℔ to 5 tons.		@	7
Kegs, lots 5 tons to 12 tons..		@	6¾
Kegs, lots 12 tons and over..		@	6¾
Lead, White, in oil, 25 ℔ tin pails, add to keg price.		@	½
Lead, White, in oil, 12½ ℔ tin pails, add to keg price.....		@	1
Lead, White, in oil, 1 to 5 ℔ assorted tins, add to keg price.		@	2½
Lead, Red, bbls. and ½ bbls....	6½	@	7¼
Lead, Red, kegs.....	6¾	@	7½
Litharge, kegs.....	6¾	@	7½
Litharge, bbls. and ½ bbls.....	6½	@	7¼

TERMS, &c.—Lead and Litharge.—On lots of 1000 ℔ or over, 60 days' time or 2¼ % discount for cash if paid within 15 days of date of invoice.

Ocher, Rochelle.....	1.35	@	1½
Ocher, French Washed....	1½	@	2½
Ocher, German Washed....	1½	@	3
Ocher, American.....	½	@	1¼
Orange Mineral, English...	8½	@	9½
Orange Mineral, French....	9	@	9¾
Orange Mineral, German ..	8½	@	9½
Orange Mineral, American.	8	@	8½
Paris White, English Cliff-stone.....	90	@	1.10
Paris White, American.....	70	@	80
Red, Indian, English.....	5½	@	7
Red, Indian, American.....	2	@	6
Red, Turkey.....	9	@	14
Red, Tuscan.....	9	@	11
Red, Venetian, American.. ₱ 100 ℔.	1.00	@	1.35
Red, Venetian, English....	1.25	@	1.75
Sienna, Italian, Burnt and Powd. ₱ ℔.....	5	@	6½
Sienna, Ital., Burnt Lumps	1½	@	2½
Sienna, Ital., Raw, Powd..	5	@	6½
Sienna, Ital., Raw Lumps..	2	@	3½
Sienna, American, Raw....	1½	@	1¾
Sienna, American, Burnt and Powdered.....	1½	@	1¾
Talc, French.....	1½	@	1½
Talc, American.....	1	@	1½
Terra Alba, Fr'ch. ₱ 100 ℔	72½	@	80
Terra Alba, English	80	@	85
Terra Alba, American No.1	70	@	75
Terra Alba, American No.2	38	@	40
Umber, Turkey, Bnt. and Powd.,..... ₱ ℔	3½	@	4
Umber, Turkey Bnt.Ln	2½	@	3
Umber, Turkey, Raw and Powdered.....	3½	@	..
Umber, Turkey, R'w Lmps	2½	@	2¾
Umber, Tu.key, Bnt. Amer.	1½	@	1¾
Umber, Turkey, R'w Amer.	1½	@	1¾
Yellow, Chrome.....	10	@	25
Vermilion, Americ., Lead..	11½	@	13
Vermilion, Quicks'er, bulk.	..	@	77½
Vermilion, Quicks'er, bags.	..	@	78½
Vermilion, Quicksilver, smaller pkgs.....	..	@	82½
Vermilion, English Import	85	@	87½
Vermilion, Imitation, Eng.	8	@	25
Vermilion, Trieste.....	87½	@	90
Vermilion, Chinese.....	90	@	95
Whiting, Common. ₱ 100 ℔	40	@	45
Whiting, Gilders'.....	50	@	55
Zinc, American, dry.... ₱ ℔	4½	@	5
Zinc, French, Red Seal.....	..	@	8½
Zinc, French, Green Seal..	..	@	8¾
Zinc, French, V. M. X.....	..	@	7
Zinc, Antwerp, Red Seal...	..	@	7½
Zinc, Antwerp, Green Seal	..	@	8½
Zinc, Germ'an, L. Z. O....	..	@	6¾
Zinc, V. M. in Poppy Oil, G. Seal, lots of 1 ton and over.....	10¾	@	11¼
lots less than 1 ton	11	@	11½
Zinc, V. M. in Poppy Oil, Red Seal,.....	..	@	..
lots of 1 ton and over....	10	@	10½
Lots of less than 1 ton....	10½	@	10¾

DISCOUNTS.—French Zinc.—Discounts to buyers of 10- bbl. lots of one or assorted grades. 1 %; 25 bbls. 2 %, 50 bbls, 4 %. No discount allowed on less than bbl. lots.

Colors in Oil.

Blue, Chinese ..... ₱ ℔	35	@	40
Blue, Prussian.....	20	@	45
Blue, Ultramar.ine.....	12	@	18
Brown, Vandyke.....	7	@	12
Green, Chrome.....	8	@	13
Green, Paris.....	16	@	18½
Sienna, Raw.....	7	@	13
Sienna, Burnt.....	7	@	13
Umber, Raw.....	7	@	10
Umber, Burnt.....	7	@	10

Glue.

Low Grade..... ₱ ℔	8	@	10
Cabinet.....	12	@	14
Medium White.....	13	@	15
Extra White.....	17	@	20
French.....	10	@	22½
English.....	10	@	15
Irish.....	12	@	18

CURRENT METAL PRICES.

OCTOBER 15, 1890.

The following quotations are for small lots. Wholesale prices, at which large lots only can be bought, are given elsewhere in our weekly market reports.

IRON AND STEEL.

Bar Iron from Store.

Common Iron :	
¾ to 2 in. round and square.. 1 to 6 in. x ⅜ to 1 in.....	₩ lb 2 00 @ 2.10¢
Refined Iron :	
¾ to 2 in. round and square.. 1 to 4 in. x ⅜ to 1½ in..... 4½ to 6 in. x ⅜ to 1 in.....	₩ lb 2.10 @ 2.30¢
1 to 6 in. x ¼ and 5-16	₩ lb 2.30 @ 2.50¢
Rods—⅝ and 11-16 round and sq..	₩ lb 2.20 @ 2.40¢
Bands—1 to 6 x 3-16 to No. 12.....	₩ lb 2.40 @ 2.60¢
"Burden Best" Iron, base price..	₩ lb..... 3.00¢
Burden's "H. B. & S." Iron, base price.....	₩ lb..... ₩ 8⅓
"Ulster".....	₩ lb..... 3.00¢
Norway Bars.....	4.00¢
Norway Shapes	5.00¢

Merchant Steel from Store.

	Per pound.
Open-Hearth and Bessemer Machinery, Toe Calk, Tire and Sleigh Shoe, base price in small lots.....	2¾¢
Best Cast Steel, base price in small lots	8 ¢
Best Cast Steel Machinery, base price in small lots.....	5¢

Sheet Iron from Store.

	Common		American.		R. G.		Cleaned.
10 to 16.....	₩ lb 3.00	@	3.00¢		3.50	@	....¢
17 to 20.....	₩ lb 3.25	@	3.25¢		3.50	@	3.75 ¢
21 to 24.....	₩ lb 3.35	@	3.35¢		3.75	@	....¢
25 and 26....	₩ lb 3.45	@	....		3.75	@	....¢
27.....	₩ lb 3.55	@	3.62½¢		4.00	@	....¢
28.....	₩ lb 3.75	@	....¢		4.25	@	....¢
	B. B.				2d qual.		
Galv'd, 14 to 20,	₩ lb, 5.00	@	...		4.75½	@	....¢
Galv'd, 21 to 24,	₩ lb, 5.37½	@	...		5.12½	@	....¢
Galv'd, 25 to 26,	₩ lb, 5.75	@	...		5.50	@	....¢
Galv'd, 27.....	₩ lb, 6.12½	@	...		5.85½	@	....¢
Galv'd, 28.....	₩ lb, 6.50	@	...		6.23	@	....¢
Patent Planished.....	₩ lb A 10¢				B, 9¢		
Russia.....	₩ lb 9½¢ @ 10¢						
American Cold Rolled B. B.....	₩ lb 5¢ @ 7¢						
Craig Polished Sheet Steel.....	₩ lb, 8½¢						

English Steel from Store.

Best Cast	₩ lb 15 ¢
Extra Cast	₩ lb 16½ @ 17 ¢
Swaged, Cast.....	₩ lb 16 ¢
Best Double Shear.....	₩ lb 15 ¢
Blister, 1st quality.....	₩ lb 12 ¢
German Steel, Best.....	₩ lb 10 ¢
2d quality.	₩ lb 9 ¢
3d quality	₩ lb 8 ¢
Sheet Cast Steel, 1st quality.....	₩ lb 15 ¢
2d quality.....	₩ lb 14 ¢
3d quality.....	₩ lb 12½¢
R. Mushet's "Special"	₩ lb 48 ¢
" " "Titanic".....	₩ lb 20 ¢

METALS.

Tin.

	Per lb
Banca, Pigs.....	24½¢
Straits, Pigs.....	24 ¢
Straits in Bars	27 ¢

Tin Plates.

Charcoal Plates.—Bright.

			Per box.
Melyn Grade.....	IC, 10 x 14..	@	$6.50
" "	IC, 12 x 12..	@	6.75
" "	IC, 14 x 20..	@	6.50
" "	IC, 20 x 28..	@	13.25
" "	IX, 10 x 14..	@	8.00
" "	IX, 12 x 12..	@	8.25
" "	IX, 14 x 20..	@	8.00
" "	IX, 20 x 28..	@	16.00
" "	DC, 12½ x 17.. ..	@	6.00
" "	DX, 12½ x 17..	@	7.50
Calland Grade.....	IC, 10 x 14,.	@	6.50
" "	IC, 12 x 12..	@	6.75
" "	IC, 14 x 20,. .	@	6.40
" "	IX, 10 x 14.. ..	@	7.65
" "	IX, 12 x 12..	@	7.90
" "	IX 14 x 20.	@	7.65
Allaway Grade.....	IC, 10 x 14.. ...	@	6.00
" "	IC, 12 x 12..	@	6.15
" "	IC, 14 x 20..	@	6.00
" "	IC, 20 x 28..	@	11.80
" "	IX, 10 x 14..	@	7.17
" "	IX, 12 x 12..	@	7.30
" "	IX, 14 x 20..	@	7.15
" "	IX, 20 x 28..	@	14.25
" " ...	DC, 12½ x 17.. ...	@	5.65
" " . .	DX, 12½ x 17.. 6.00	@	6.65

Coke Plates.—Bright.

Steel Coke.—IC, 10 x 14, 14 x 20,.	@	$5.60
10 x 20..	@	7.75
20 x 28.. ...	@	11.25
IX, 10 x 14, 14 x 20..	@	6.50
BV Grade.—IC, 10 x 14, 14 x 20.. ...	@	5.60

Charcoal Plates.—Terne.

Dean Grade.—IC, 14 x 20..	@	$5.40
20 x 28.	@	10.70
IX, 14 x 20.....	@	6.10
20 x 28.....	@	12.10
Abecarne Grade. —IC, 14 x 20...	@	5.10
20 x 28...	@	10.85
IX, 14 x 20.... ...	@	6.10
20 x 28..	@	12 10

Tin Boiler Plates.

I CX, 14 x 28.....112 sheets.....	@ $13.50
I CX, 14 x 28.....112 sheets....	@ 13 75
I CX, 14 x 31... ....112 sheets	@ 15 25

Copper.

Duty: Pig, Bar and Ingot, 4¢; Old Copper, 3¢ ₩ lb. Manufactured (including all articles of which Copper is a component of chief value), 45 % ad valorem

Ingot.

Lake.....	@ 17½¢
Baltimore Grade.....	@ 15 ¢

Sheet and Bolt.

Prices adopted by the Association of Copper Manufacturers of the United States, June 27, 1890, being quotations for all sized lots.

Not wider than	Not longer than	And longer than	Weights per square foot and prices per pound. Over 64 oz.	32 to 64 oz.	16 to 32 oz.	14 to 16 oz.	12 to 14 oz.	10 to 12 oz.	8 to 10 oz.	Less than 8 oz.
30	72		25	25	25	26	27	28	31	33
30		72	25	25	25	26	28	30	34	...
36	96		25	25	25	27	29	33	36	....
36		96	25	25	26	28	30	34	38	....
48	96		25	25	27	29	31	35	....	....
48		96	25	25	28	30	32	36	....	....
60	96		25	25	30	32	37	....	....	....
60		96	25	26	31	....	....	....	....	....
84	96		26	27	....	....	....	....	....	....
84		96	27	28	....	....	....	....	....	....
Over 84 in. wide			28	30	....	....	....	....	....	....

All Bath Tub Sheets.....	16 oz.	14 oz.	12 oz.	10 oz.
Per pound.....	$0.27	0.29	0 31	0.35

Bolt Copper, ⅝ inch diameter and over, per pound..... 25¢

Circles, 60 inches in diameter and less, 3 cents per pound advance over lowest prices of Sheet Copper of the same thickness.

Copper Bottoms, Pits and Flats.

	Per pound.
14 ounce to square foot and heavier.....	29¢
12 ounce and up to 14 ounce to square foot.....	30¢
10 ounce and up to 12 ounce.....	32¢

Circles less than 8 inches diameter 2 cents per pound additional.

Circles over 13 inches diameter are not classed as Copper Bottoms.

Tinning.

Tinning sheets on one side, 10, 12 and 14 x 48 each..... 8¢

Tinning sheets on one side, 30 x 60 each..... 30¢

For tinning boiler sizes, 9 in. (sheets 14 in. x 60 in.), each. ....15¢

For tinning boiler sizes, 8 in. (sheets 14 in. x 56 in.), each ....12¢

For tinning boiler sizes, 7 in. (sheets 14 in. x 52 in.) each..... .... 12¢

Tinning sheets on one side, other sizes, per square foot..... ....2½¢

For tinning both sides double the above prices.

Planished Brass and Copper.

14 x 48.

14 and 16 oz. and heavier..31¢. By the case...30¢ ₩ lb
12 oz. and lighter.....33¢. By the case...32¢ ₩ lb

24 x 48 and 30 x 60.

14 and 16 oz. and heavier..44¢. 12 oz.....37¢ ₩ lb

Seamless Brass and Copper Tubes.

O. G.	N. G.	⅜	½	⅝	¾	⅞	1	1½
8-14	6-12	39	35	32	31	30	29	26
15	13	40	35	33	32	31	30	27
16	14	41	36	34	33	32	31	27
17	15	42	37	35	32	33	32	28
18	16	44	38	36	34	33	32	29
19	17	45	39	37	36	35	34	31
20	18-19	46	41	39	38	37	36	33
21	20	48	43	41	40	39	38	36
22	21	50	44	42	41	40	39	38
23	22	52	46	44	43	42	41	41
24	23	55	48	46	45	43	42	43
25	24	58	51	48	47	46	45	47

Copper Bronze and Gilding Tube, 3¢ ₩ lb additional.

Brazed Brass Tubing. (To No. 20, inclusive.

Above 5-16 inch to 3 inch, inclusive	35¢
Plain, above 3 inch.....	45¢
Plain, 5-16 inch.....	45¢
Plain, ¼ inch.....	60¢
Plain, 3-16 inch.....	$1.00
Plain, ⅛ inch.....	1.50
Fancy Tubing, Brass, to No. 20, inclusive.....	45¢ ₩ lb
bronze Tubing, 3¢ ₩ lb more than Brass.	
Discount from list.....	25 @ ... %

Roll and Sheet Brass.

Discount from list..... 20 %

High Brass Rods.

Over 1 inch diameter..	29¢
¼ inch to 1 inch diameter, both inclusive.....	30¢
No. 8 and less than ¼ inch diameter.....	32¢
Smaller than No. 8.....	32¢

Hexagon, Octagon and Square, 2¢ ₩ lb advance over Round Rods.

Spelter.

Duty: Pig, Bars and Plates, $1.50 ₩ 100 lb.

Western Spelter ....6½ @ 6¾¢	
"Bertha"	8¢

Zinc.

Duty; Sheet, 2½¢ ₩ lb.

600 lb casks.....	6½¢
Per lb	7½¢

Lead.

Duty: Pig, $2 ₩ 100 lb. Old Lead, 2¢ ₩ lb. Pipe and Sheets, 3¢ ₩ lb.

American	5¾¢
Bar.....	6½¢
Pipe, subject to trade discount....	8%
Tin-Lined Pipe, subject to trade discount.....	15¢
Block Tin Pipes, subject to trade discount.....	45¢
Sheet, subject to trade discount.....	8¾¢

Solder.

½ @ ½ (Guaranteed)...	16½¢
No. 1.....	13
Extra Wiping.....	11½¢ @ 13

The prices of the many other qualities of Solder in the market indicated by private brands vary according to composition.

Antimony.

Cookson.....	₩ lb 23¢
Hallett's.	" 21¢

ALUMINUM.

Prices in Ingots.

$2.00 ₩ lb in lots of 1000 lb and over.
$2.25 ₩ lb in lots of 500 lb and over.
$2.50 ₩ lb in lots of 100 lb and over.

Prices Per Pound on Rolled Sheets.

(Brown & Sharpe, Standard Gauge.)

Wider than. ..... And including.....	2 in. 10 in.	10 in. 14 in.	14 in. 18 in.	18 in. 22 in.	22 in. 24 in.
Up to No. 20 inclusive...	$2.50	$2.60	$2.80	$3.00	$3.20
Nos. 21, 22, 23 and 24....	2.60	2.70	2.90	3.10	3.30
Nos. 25 and 26.....	2.70	2.80	3.00	3.20	3.40
Nos. 27 and 28.....	2.80	2.90	3.10	3.30	3.50

Sheets, thinner than No. 28 gauge and wider than 24 inches, special prices not less than $5 per pound.
Add 30 cents per pound for sheets cut to particular widths and lengths.
Sheets rolled to .001 in. and under, 50 cents per ounce.
Leaf in books, 20 cents per book; $2 per pack of 10 books, sheets 5 x 5 inches.

Aluminum Tubing.

From $4 per pound upward, according to size and thickness of walls.

Aluminum Castings.

From 50 cents upwards per pound extra over the cost of the metal in ingots, according to the number wanted, weight, the difficulty of casting, cost of patterns, &c.

Aluminum Wire in Coils.

(Brown & Sharpe, Standard Gauge.)

	Per lb
All numbers up to No. 24 (.064 in.) inclusive.....	$3.00
Nos. 15 (.05706 in.) to 22 (.02534 in.) inclusive....	3.25
Nos. 23 (.02571 in.) and 24 (.0201 in.) inclusive....	3.50
Nos. 25 (.0179 in.) and 26 (.01594 in.) inclusive....	3.75
Nos. 27 (.014195 in.) and 28 (.012641 in.) inclusive	4.00
Nos. 29 (.011257 in.) and 30 (.010023 in.) inclusive	4.25
No. 31 (.008928 in.).....	4.50
No. 32 (.00795 in.).....	4.75
No. 33 (.00708 in.).....	5.00
No. 34 (.00630 in.).....	5.25
No. 35 (.00561 in.).....	5.75
No. 36 (.00500 in.).....	6.25
No. 37 (.00445 in.).....	7.00
No. 38 (.003965 in.).....	8.50
No. 39 (.003531 in.).....	12.00
No. 40 (.003144 in.).....	16.00

Spooling, on 1-pound spools, 15 cents per pound extra
Spooling, on 10-pound spools, 5 cents per pound extra

Old Metals.

(Prices Paid in New York.)

Heavy Copper.....	₩ lb	12 ¢
Light Copper.....	₩ lb	11 ¢
Heavy Brass.....	₩ lb	10 ¢
Light Brass.....	₩ lb	8 ¢
Lead.....	₩ lb	4 ¢
Tea Lead.....	₩ lb	3½¢
Zinc.....	₩ lb	3 ¢
No. 1 Pewter.....	₩ lb	16 ¢
No. 2 Pewter	₩ lb	8 ¢
Wrought Scrap Iron.....	₩ gross ton	$19.00
Heavy Cast Scrap.....	₩ gross ton	12.00
Stove Plate Scrap.....	₩ gross ton	8.00
Burnt Iron.....	₩ gross ton	6.00